NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

STRATEGIC INFORMATION TECHNOLOGY PLAN

FY 2000 - FY 2003

Information Resources Management Staff

Information Systems Office

Office of Finance and Administration

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This plan was produced in part as input to NOAA's FY 2001 Strategic Planning/Budget Process. As such, information in it may require revisions upon completion of that process. An electronic version is available at "http://www.rdc.noaa.gov/~irm/index.html".

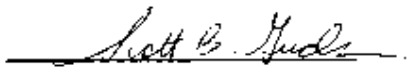
PREFACE

The National Oceanic and Atmospheric Administration (NOAA) Strategic Information Technology (IT) Plan establishes a vision for how information technology contributes to NOAA's ability to accomplish the seven strategic goals identified in the NOAA Strategic Plan. It presents NOAA's requirements for IT systems in terms of these strategic goals and identifies the IT actions necessary to reach those objectives. It has a close relationship with NOAA's 5-Year Implementation Plans. This linkage in turn supports the NOAA, DOC, and OMB budget-development processes by showing how specific IT initiatives are part of an overall strategy that is essential to attain NOAA's programmatic goals. The plan integrates information on NOAA's IT programs, requirements, and issues, providing a useful management tool for tracking the general status and direction of IT management within the agency. Finally, the plan responds to Congressional and Office of Management and Budget (OMB) direction that agencies must develop strategic IT plans to ensure the sound management of this resource so crucial to Government operations.

The NOAA Strategic IT Plan identifies how NOAA is using IT to achieve its strategic goals. NOAA prepares a more specific annual Operational IT Plan for submission with its budget request, documenting NOAA's accomplishments with its prior use of IT resources and its short-term plans for further actions and accomplishments. Budget Initiatives with substantial IT components are supported with additional documentation detailing specific life-cycle system plans. At the lowest level of planning, an analysis of alternative solutions to a specific IT requirement is prepared for any proposed major acquisition.

This Strategic IT Plan supports the development of NOAA's 5-Year Implementation Plans. Information on NOAA's strategic systems has been supplied by the individual system managers through their Line Office's Chief Information Officer or Information Technology Coordinator. The strategic issues addressed in this plan were selected for inclusion by NOAA's Information Technology Board, chaired by the Deputy Under Secretary and comprised of Deputy Assistant Administrators and Program Office Directors. The Board is also responsible for reviewing the contents of this plan and recommending endorsement to the Deputy Under Secretary.

As NOAA's 5-year Implementation Plans are revised and budget decisions are made, some of the contents of the Strategic IT Plan will need adjustment. Readers should be aware that this document reflects NOAA's plans at this point in the process – the other parts of the NOAA IT planning system will document changes that would affect NOAA's specific budget requests.



Submitted by: Scott B. Gudes
Deputy Under Secretary

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NOAA'S MISSION AND INFORMATION TECHNOLOGY ENVIRONMENT

Agency Mission

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to describe and predict changes in the Earth's environment, and to conserve and manage wisely the Nation's coastal and marine resources to ensure sustainable economic opportunities. The NOAA Strategic Plan provides a framework for articulating program goals, and it establishes two mission areas: (1) Environmental Assessment and Prediction and (2) Environmental Stewardship. NOAA's mission is also described on NOAA's home page on the World-Wide-Web (http://www.noaa.gov).

NOAA's Information Technology Environment

NOAA is a science-based service agency. In support of its missions, it collects, processes, evaluates, disseminates, and archives vast quantities of information and information products. The effective use of information technology (IT) is a critical success factor in NOAA's ability to accomplish its mission, and the use of IT is integrated into almost all aspects of NOAA's work. NOAA's Strategic Plan recognizes the critical role of environmental data and information services.

IT allows NOAA to vastly increase the amount and quality of environmental data collected. IT is an integral part of environmental data-collection systems, including radar, sonar, and satellite systems. Once collected, the data are evaluated and processed to create useful products. NOAA uses advanced computing technology, for instance, to make weather and climate forecasts. IT resources are also essential tools that NOAA uses to produce information products such as nautical and aeronautical charts and management tools such as quotas for specific species of fish.

Once produced, these information products are disseminated to the public. IT allows NOAA to provide its products to the public in a timely manner. In the case of a weather warning, "timely" means immediately through systems such as the NOAA Weather Radio system or through links to emergency management offices. Other products are disseminated in "real- time" to allow the preparation of forecasts. NOAA also serves the research community that needs reliable and responsive access to NOAA data covering extended periods of time.

NOAA uses IT to create and preserve the Nation's long-term environmental record. The Nation's ability to make informed decisions affecting the environment and the economy hinge on the integrity and completeness of environmental datasets. As NOAA collects and processes a larger volume of environmental data, the systems that archive and preserve the data for posterity must keep pace.

NOAA is a large and diverse organization linked together with a common mission. IT provides one of the links that allows the organization to operate effectively. Internal communication and collaboration are done through electronic mail and video conferencing. In addition, numerous day-to-day operations are conducted through the use of common administrative systems.

The management and use of IT are and will always be key components of NOAA's work.

NOAA's Current Information Technology Infrastructure

NOAA's IT infrastructure is too complex to easily summarize. Supercomputers are used to develop and use models of the environment to make predictions. Scientific workstations are often used for computationally-intensive tasks and as servers, although the increased power of PCs is leading to some change in the mix between scientific workstations and PCs. The basic desktop unit within NOAA is the PC. With the exception of efforts to plan for the use of supercomputers within the agency, decisions about the mix of computing equipment are decided by the program offices.

NOAA depends heavily on the Internet and internal networks to accomplish its goals and to disseminate information to the public. As a scientific agency, NOAA has been a government leader in the use of World-Wide-Web sites for a variety of purposes. NOAA sites are routinely accessed by the public in very large numbers, and in special situations such as hurricanes the numbers grow even larger.

NOAA is slowly moving away from internally-developed software to commercial off-the-shelf software when such a move is a viable and affordable option.

Vision for the Future

NOAA's overall mission, as expressed in the NOAA Strategic Plan, is stable and is not expected to significantly change over time. NOAA is rapidly improving the products and services provided to the public by using IT resources effectively. Thus, NOAA's IT vision focuses on finding ways to continue to use IT to accomplish NOAA's strategic goals.

In an era of stagnant or falling budgets, this vision requires that financial and staff resources be allocated carefully. Planning and decision-making must be conducted thoroughly and analytically so that resources can be directed so as to maximize the benefits to the country. Identifiable and measurable goals must be established.

NOAA has established an IT Board with senior management representation from each of NOAA's Line Offices. The role of the IT Board is to develop policy, oversee efforts to address enterprise-wide technical issues, and to review investment proposals and recommend priorities.

Once investment decisions are made, NOAA's program officials must have the ability to quickly and cost-effectively implement these decisions and acquire the needed resources. Given the rate of technological change, time is of the essence when acquiring modern technology. Lengthy

delays during the procurement process are burdensome and potentially costly. Where appropriate, NOAA strives to share or leverage existing resources for the common good. This includes the development of common standards-based architectures.

Managers responsible for developing new systems must have the benefit of lessons learned from past experiences. The use of "best practices" for project management and software engineering techniques for system design and implementation must be emphasized.

Finally, the performance of operational IT systems must be measured and evaluated. The goal must be continuous improvement, not the status quo.

DEPARTMENT OF COMMERCE STRATEGIC ISSUES

Introduction

The Department has identified two issues of Department-wide concern: achieving a "Digital Department of Commerce" and using information technology to reduce public reporting burden. This chapter addresses NOAA's actions in addressing these issues.

Achieving a "Digital Department of Commerce"

NOAA is very active in using digital means to conduct its business. NOAA's activities in this area includes: (1) electronically disseminating or making information available to the public, (2) using digital means to conduct internal or inter-agency business, (3) the use of digital means to obtain information from the public, and (4) electronic commerce applications that involve the exchange or transfer of money.

Information Dissemination - One of NOAA's primary functions is to provide the public with a wide variety of information. NOAA's very active development of World-Wide-Web (WWW) sites has revolutionized how most of its programs make information available. The public, and NOAA and other Federal personnel, can not only learn about NOAA's programs and activities, but can electronically obtain an enormous amount and variety of data. This includes meteorological, oceanographic, and geophysical data; climate and research data; satellite data; data on commercial and recreational marine fisheries; geodetic data; and so on. Many sites are heavily used by the public - an extreme case is the National Hurricane Center site during hurricane events.

NOAA programs also use other electronic means to disseminate data and information. The National Weather Service is the primary example, using such means as satellite communications systems, radio, weather-by-phone, dedicated communication lines, and so forth. Some of these involve fees, others are free. NOAA also produces and makes available (for sale) a large number of CD-ROMs with environmental and other data.

A special case of electronic dissemination is the Physical Oceanographic Real-Time System (PORTS). This system provides ship masters, pilots, and others with accurate real-time data on water levels, currents, and other information that helps avoid collisions and groundings, as well as allowing more efficient planning for maximum vessel tonnage and passage times.

Internal and Inter-Agency Business - Digital means are also used to internally conduct many of NOAA's activities. E-mail is a primary method of communication and transmitting files. Various personnel, procurement, property, and other functions use the WWW to provide information to NOAA employees and to let them take certain actions. Digital means are used to automate the work flow between many NOAA offices, and also between NOAA offices and other agencies with related programs.

Obtaining Information From the Public - NOAA has been less active in using digital means to obtain information from the public, but some applications are in place and others are under development. In some of the regions of the National Marine Fisheries Service fish dealers can make their required reports electronically. In a few fisheries, vessel monitoring systems are required on vessels to automatically and electronically report on the vessel's location, providing NOAA with accurate and up-to-date information for enforcement while eliminating the need for the vessel operator to phone in reports on when the vessel leaves and returns to port. Also in the fisheries area, a number of coordinated projects are underway to develop electronic logbooks for reporting fishing effort and catch. The National Ocean Service provides means for submitting geodetic survey project data digitally over the Internet. The Coastal Services Center has a system that allows anyone to submit information via the File Transfer Protocol (FTP). Also in the National Ocean Service, the Coastal and Marine Management Program not only provides information on certain grants and projects, but will allow electronic applications to be submitted.

A significant deterrent to the development of many additional applications is the digital signature problem. This is not so much a technical problem as one of resources. Offices that are hard-pressed in terms of money and time to support their basic IT activities cannot afford to develop these new systems, especially when the number of persons involved may be fairly low.

Electronic Commerce - NOAA conducts a limited number of activities that could be categorized as "electronic commerce" in the strict sense of the electronic exchange of funds. The NOAA National Data Centers Online Data Store allows users to order, pay for, and retrieve products and data over the Internet. The NOAA National Environmental Data Archive and Access System will take this a step further to provide seamless access to data center holdings regardless of their location. NOAA has also established an electronic means for anyone in the Department of Commerce to acquire a variety of IT products and services; there is on-line ordering and credit cards can be used to pay for the orders. NOAA also has a system that allows persons claiming reimbursement for expenses related to permanent changes of duty station to be reimbursed through electronic transfers of funds as a direct deposit, with the appropriate withholdings being made automatically. Other projects are under consideration.

The Use of IT to Reduce Public Reporting Burden

NOAA is pursuing a number of efforts to use IT to reduce public reporting burden.

Forms on the Web - NOAA continues to make forms necessary for application or reporting requirements available to the public from NOAA's World-Wide-Web (WWW) sites. Although the public cannot usually complete and submit the forms on-line, the effort to obtain the forms has at least been reduced. If and when the Department of Commerce (DOC) or NOAA reaches a decision on an electronic forms package, NOAA could look to at least provide more fillable forms on the WWW. Currently limited resources make it difficult to implement the electronic signature systems that would be necessary to allow electronic submissions, but NOAA will continue to review the status of this technology and where it might be economical to use it.

Forms Electronically Pre-completed - NOAA continues to use technology to ease the burden of applying for renewal of many fishing permits. NOAA often sends the permit holder a renewal application form that has already been filled out by computer with the existing application information on record. The applicant only has to review the data to ensure that it is still accurate, make any changes needed, sign the application, and mail it in. By eliminating the need to complete address, vessel, and other information fields that have not changed, NOAA has reduced the response time by 50%. In the future NOAA will be examining renewal procedures that do not use this technique, and when it is feasible will bring more processes under this system.

Vessel Monitoring Systems - In some highly-stressed fisheries there are limitations on the number of days that fishermen can fish. In the past these fishermen have had to report when they were leaving on a fishing trip and when they ended the trip. In other fisheries fishermen were prohibited from fishing near certain areas, or from being within a certain distance of fishing grounds before the fishing season opened. Because of enforcement difficulties, the prohibited distance could be quite far (e.g. 200 nautical miles in one case). Vessel monitoring systems are pieces of equipment that can be placed aboard fishing vessels and that can automatically report the location of the vessel. This substantially reduces the burden by eliminating reports that would otherwise be required. Area restrictions can also be less strict, since the accuracy of reporting makes it easier for enforcement officials to know that vessels have not strayed into prohibited areas. In Hawaii, for instance, restrictions on crustacean vessels were reduced from 200 to 50 nautical miles. There are issues concerning the cost of this equipment, so it is not appropriate for all situations, but its use illustrates another method of automation that NOAA considers to reduce burden while improving enforcement. The potential use of the systems is analyzed on a fishery-by-fishery basis.

Electronic Dealer/Processor Reporting - Several efforts are underway to allow fishery dealers and processors to provide NOAA with data output from their existing computer systems, rather than responding to a set NOAA-required paper reporting form. These efforts will reduce the burden on the respondents and provide data that can be entered into NOAA's data bases more easily. The Alaska Region of NMFS offers software that processors can download to prepare and submit a number of required reports. This is expected to substantially reduce burden on this segment of the fishery while making NOAA's job of processing the data much easier.

Electronic Fishing Vessel Logbook Projects - In many commercial fisheries the operators of participating vessels are required to maintain catch and effort logbooks either by a state or by NOAA. In most cases fishermen would maintain some form of logbook for their own use, so the Federal burden imposed involves the use of additional data fields and the actual submission of the logbooks to the government agency involved. NOAA currently has two projects underway that seek to develop electronic logbooks. Both projects involve the automatic entry of some data from sensors in addition to information entered on a PC. If successful, an electronic logbook reduces the burden on the fishermen while producing better data more quickly and in a readliy-usable form.

Telephone Reporting - NOAA has a number of requirements that involve the respondent telephoning information to the agency. Two of the more recent requirements involve more

innovative uses of this approach. Certain fisheries dealers in the Northeast will be required to report purchases weekly via an interactive voice response system. While it does not reduce burden on the dealers, it allows NOAA to obtain and analyze the data more quickly, thereby improving the management of these fisheries. The other requirement, already in place, is that recreational fishermen landing medium or large-sized Atlantic bluefin tuna must call in catch information to an automated system. This involves relatively low burden on the respondent, while quickly providing NOAA with information needed for management.

NOAA-WIDE INFORMATION TECHNOLOGY STRATEGIC ISSUES

NOAA's leadership recognizes the importance of IT as an enabler that allows NOAA to accomplish its mission. IT is critically important to NOAA's ability to accomplish each of its seven strategic goals. The individual systems being planned, deployed, or operated to accomplish these goals are described later in this plan. However, IT also needs to be managed at the enterprise level. Over-arching issues and management requirements exist and must be addressed for the organization as a whole.

This section of NOAA's Strategic IT Plan describes these management issues, provides a status report on NOAA's progress in dealing with them, and outlines NOAA's plans for dealing with each issue. NOAA's Operational IT Plan will describe in detail the specific initiatives that are being undertaken to deal with these issues over the next few years.

Information Services Delivery

Description: In previous plans this issue was called "Connectivity and Networking". The issue has been renamed to focus attention on the fact that NOAA's telecommunications infrastructure is key to NOAA's ability to carry out its mission, the delivery of information products and services both internally and externally.

All aspects of the NOAA enterprise, including research, operations, and administration, rely on network communications to conduct the agency's business. This trend has rapidly accelerated as effective network speeds and bandwidths have increased. The collection and dissemination of data are done across networks using the World-Wide-Web. Electronic mail has become the medium of communications for virtually all types of correspondence and collaboration. NOAA's administrative systems, including efforts to implement electronic commerce, are built on a foundation of reliable open-systems communications. Computing resources are also accessed through high-speed links. In order to realize the true promise of network and Internet technology, increased coordination of network resources must be implemented to ensure both the efficient use of resources and the availability of adequate capacity to serve the information needs of the public. Vigilance against security threats is critically important. NOAA also must keep abreast of emerging technologies. A vision of NOAA's networking future must be developed so that NOAA is positioned to benefit from future technological advances.

Status: For over five years NOAA has had in place a Network Advisory Review Board (NARB), a working group empowered to coordinate the development of NOAA networking policy. The NARB membership has representation from NOAA's Line and Program Offices. NARB accomplishments include: issuing a policy document, the NOAA Interoperability Profile (NIP), to provide a standards-based approach to networking that ensures that systems can interoperate; establishing a Network Information Center (NIC) to provide network services to the NOAA

community; establishing Network Operations Centers (NOCs) to manage NOAA networks on a campus-wide basis; and developing a NOAA policy on the use of the Internet.

The Information Systems Office (ISO) of the Office of Finance and Administration (OFA) developed a comprehensive status report and assessment of NOAA's telecommunications requirements. This Telecommunications Assessment was coordinated with the NARB, which endorsed the document in January, 1998. The document lists the telecommunications "challenges" that NOAA needs to face in order to maximize its ability to efficiently deliver information services to the public.

NOAA's Program Synergy Team, a high-level group of managers tasked to look for ways for NOAA's programs to work together more effectively, has recommended that a NOAA Intranet be established. The Under Secretary formally endorsed this recommendation in a decision memorandum. A working group has been established to plan and implement such an Intranet. The initiative will focus on improving data and information access within NOAA.

Future Direction/Actions: NOAA has recognized that networking and connectivity issues transcend internal organizational boundaries. The Telecommunications Assessment is being used to prepare a NOAA telecommunications "action plan". This plan will document how NOAA will collectively address NOAA's telecommunications challenges, and it will also serve as supporting documentation for a possible FY 2001 budget initiative to supplement existing telecommunications funding. A key challenge in this effort is the development of an overall telecommunications architecture for NOAA. This architecture will provide the framework for NOAA's telecommunications planning. NOAA's planning will also benefit from efforts to update its telecommunications baseline - efforts which are being done in conjunction with the Department's telecommunications survey.

NOAA is considering the submission of a "NOAA Information Services Delivery Initiative" (NISDI) for the FY 2001 budget submission. The objective of the initiative is to enhance NOAA's ability to manage and operate its information services delivery infrastructure, serving both internal and external clients. Four core corporate functions are targeted: (1) network management, (2) Web Farm or central computing management, (3) enterprise messaging, and (4) security. Enhanced network capacity is implicit in providing these services. The development of these capacities will have a direct and immediate impact on the way that NOAA employees work and communicate, as well as exchange data and use computing resources.

This initiative will result in NOAA's network resources being managed and monitored through NOCs. This approach will improve the operations of NOAA's telecommunications resources, allow performance-based planning to ensure that capability keeps pace with demand, and greatly improve NOAA's ability to secure its information resources from outside attack. Web Farms will be established to insulate NOAA's publicly-accessible information resources from resources restricted to internal use. NOAA currently operates an enormous number (over 500) web sites. The Web Farms will improve the management of these Web sites by consolidating them on a smaller number of hardware platforms, securing them, and professionally managing them. Finally, NOAA has started a strategic transition to a common enterprise-wide messaging environment.

This project has been started by painfully collecting funds from each Line Office. The NISDI would provide funding to support this strategic part of NOAA's infrastructure with a stable budget and provide continuous technology refreshment on a routine basis.

Information Services Delivery Performance Measures	FY 99	FY 00	FY 01
Legacy networks retired	-	0	0
Web Farms in operation	-	1	3
Integrated campus operations	-	4	6
Days of saturated service	-	45	20

Information Services Delivery Milestones	FY Goal
Develop and test Web Farm concept at Silver Spring campus	FY 00
Develop campus management strategy in accordance with the NOAA Enterprise Network Architecture preparatory to FY 01 funding	FY 00
Update target architecture (this will become annual milestone)	FY 00
Implement Web Farms at two major mirror sites	FY 01
Initiate campus management concept at two sites	FY 01
Implement Messaging Support Center	FY 01
Implement Web Farms at two secondary mirror sites	FY 02
Implement campus management at two additional sites	FY 02
Implement Web Farms at last secondary mirror sites	FY 03
Initiate campus management concept at final four sites	FY 03
Begin technology refreshment cycle at Phase 1 sites	FY 03
Refresh technology at Phase 2 sites	FY 04

Cost Estimates ($K): Includes all hardware, software, operational, and support costs associated with addressing the issue. Also includes personnel costs for individuals whose primary task is system development, operations, or support.

Issue	FY 99	FY 00	FY 01
Information Services Delivery	0	0	3,500

Contact Point: William Turnbull (301-713-3573) and Robert Swisher (301-763-6300)

Year 2000 (Y2K)

Description: NOAA and its predecessor organizations were pioneers in the use of computer technology. Over the approximately 40 years that computers have been in use, NOAA has developed customized software to handle both programmatic and administrative requirements. As is now well known, hardware and cost limitations often required the use of short-cut software techniques designed to conserve computing storage space. One such technique was to use two digits to reflect the 20th century. For dates beginning in the year 2000, this space-saving technique will cause major errors and failures as programs will read "00" as 1900 instead of 2000.

NOAA's systems are, for the most part, not date centric (used for calculations, sorting, comparing, etc.). For example, the communications headers used to disseminate real-time weather data do not require any year or month element. The only date information contained in any disseminated weather product's data headers are the day of the month and Universal Time Coordinated (UTC) hour of the day. For example, in the 25th day of any month at 1700 hours UTC, the data header would read 251700. As for data-processing purposes, only a very small subset of weather products contain any year information that is embedded in the data itself. Progress is well underway in modifying all software that processes this small subset of data. NOAA has created test Y2K datasets of these types of data and has made them available to many of the organizations that have external data exchanges with the NOAA. It also has been verified that there is no date issue with the satellite data.

Nonetheless, NOAA still must ensure that its computer systems, both hardware and software, will continue to function properly when they are called upon to process dates in 2000 and beyond. NOAA must ensure that legacy software is repaired, replaced, or retired; that commercial off-the-shelf software is compliant and will function properly; and that computer hardware is upgraded to process the correct date fields. NOAA is also ensuring that its physical systems at the various locations and on its platforms will be Y2K-ready.

The solution to the problem cannot be postponed. Managing the successful completion of the necessary corrective actions is critical to NOAA operations and, more significantly, to the well-being of the Nation.

In recognition of the importance and the time-critical nature of the problem, in June 1996, NOAA established a Y2K Task Force chaired by the Manager for Systems Engineering of the Systems Acquisition Office with participation by each of the Line and Staff Offices. The Task Force initially focused on promoting awareness of the Y2K problem; developing an inventory that

determined problem magnitude; and preparing rough cost estimates for implementing corrections. Subsequently, each Line and Staff Office developed a corrective action plan and became responsible for implementing it. The plans addressed the awareness, assessment, renovation, validation, and implementation phases as required in Office of Management and Budget directives. The Task Force reports regularly to the NOAA IT Board to ensure that NOAA's plans are on track. In addition, the Deputy Under Secretary (DUS) meets quarterly and as necessary with the Offices to review progress on renovation, validation, and implementation efforts.

The awareness phase is a continuous process. As noted, the NOAA IT Board and DUS regularly review Y2K progress and issue and disseminate information updates throughout NOAA. The Y2K inventory, initially developed in June of 1996, was updated most recently in March 1999 and transmitted to the DOC for its Y2K database that will enable it to respond to inquiries more promptly and effectively.

Status:

Mission-Critical Systems: NOAA's most recent OMB monthly benchmark report for March 1999 addressed 117 mission-critical systems. Excluded were the two Advanced Weather Interactive Processing System (AWIPS) development systems (hardware and Forecast Systems Laboratory software) that were removed from the reporting process and are monitored separately. Of the 117 systems, 114 systems are compliant, 2 are to be replaced, and 1 remains to be repaired.

The assessment phase for the 29 baseline repair systems was completed in October 1997. The Government-wide implementation date for repair of systems was March 31, 1999. NOAA met that target except OAR's FSL Wind Profiler, which completed implementation on April 1, 1999.

Facilities: The Office of Finance and Administration is working closely with the all NOAA Offices on identifying embedded chip issues at its facilities around the country. To determine if there were any potential Year 2000 problems, in-house office personnel surveyed the components in NOAA-owned and operated facilities within the Washington Metropolitan Area, (i.e., the National Capitol Region), the field, and the Administrative Support Centers. Letters were sent to the owners and landlords in the Washington metropolitan area and in the field for NOAA commercial leased facilities to ensure they are Y2K-compliant. Various power and gas companies were contacted to inquire about their respective Y2K-compliance programs. NOAA's Facilities Management Division has developed a formal Y2K testing plan for NOAA-owned and commercial leased facilities within the Washington metropolitan area, field offices, and the Administrative Support Centers.

NOAA is still conducting the Y2K-compliance assessment of its 540 DOC/NOAA-owned facilities and 268 DOC/NOAA-leased facilities. As of March 31, 1999, of the DOC/NOAA-owned facilities 457 (84%) are Y2K- compliant, 47 (9%) are not Y2K-compliant, 20 (4%) have not reported, and 16 (3%) have been or will be excessed to GSA. For the DOC/NOAA-leased facilities, 169 (63%) are Y2K-compliant, 14 (5%) are not Y2K-compliant, 66 (25%) have not reported, and 19 (7%) have leases that have been or will be terminated. NOAA is staying in contact with those who have not yet responded (as recently as December 1998 over 55% had not

reported), and is working with those reporting non-compliant facilities. The non-compliancy problems are primarily associated with the heating, ventilation, and air conditioning controls. These systems can be place on manual operation, although that arrangement is not optimal for the equipment operations.

NOAA provided a status of its Y2K-compliance progress to the Department of Commerce's Real Estate Group on April 2, 1999, for the continental United States (CONUS) and Non-CONUS facilities.

Washington Metropolitan Area: Compliance information from Potomac Electric Power Company (PEPCO) and the natural gas company in the metropolitan Washington Area has been received. The NOAA-owned and leased buildings are Y2K-compliant. Testing of one non-compliant security system in Silver Spring Metro Center Building 3 has been completed. A software patch was installed in mid-February 1999 ensuring Y2K compliance.

PC hardware and software: For over two years, NOAA has been undertaking an aggressive PC upgrade following the Federal Acquisition Regulations' (FAR) requirement of purchasing only PC hardware certified Y2K-compliant. NOAA is using either the YMark 2000 freeware tool from the National Software Testing Laboratories or the Check2000 PC from Greenwich Mean Time to test for Y2K PC hardware compliance. No significant problems have been uncovered so far.

NOAA also has been following the FAR in the acquisition of COTS software and are assessing software Y2K compliance through data bases at various Web sites, Home Pages, and other data sharing.

Telecommunications: NOAA worked closely with the Department's Office of Telecommunications Management to issue a telecommunications assessment of NOAA telecommunications assets. The telecommunications assessment was developed by the Institute for Telecommunications Sciences (ITS) of the National Telecommunications and Information Administration in cooperation with DOC. NOAA and DOC worked closely in formatting the assessment contents to more directly reflect those assets in NOAA. The assessment included telecommunications services such as, voice and data, cellular, satellite, broadcast, multimedia, public access, and Internet capabilities within NOAA. The status of the February 1998 survey by the DOC Office of Telecommunications Management was that: (1) DOC had covered 80% of DOC's telecommunications assets in its inventory and had identified where Y2K problems exist or have been fixed; (2) the remaining 20% are field locations, such as the Administrative Support Centers and fisheries locations; and (3) both the Washington Interagency Telecommunications Systems (WITS) and FTS 2000 was not then Y2K-compliant. In the 7th Quarterly Report (November 1998) to OMB the General Services Administration (GSA) reported that: (1) WITS is Y2K-compliant (fixed as of July 1998); (2) voice-mail obtained from WITS is Y2K-complaint; and (3) FTS 2000 will be replaced by FTS 2001, a Y2K- compliant system. In doing contingency planning, we are to assume that they will not work.

Washington Metropolitan Area: The Office of Finance and Administration has completed its assessment of the telephones and voice-mail systems for Y2K compliance. Findings were that the

telephones are Y2K-compliant and a voice-mail system's Y2K compliancy is dependent on its make and model. Voice-mail systems that were found to be non-Y2K-compliant are either being upgraded or replaced. As of January 1999, telephone request orders have been received to have 12 voice-mail systems upgraded for Y2K compliance.

The Administrative Support Centers have completed conducting assessments of their telephones, voice mail systems, and fax machines for Y2K compliance. Primary findings are that the telephones are Y2K-compliant and the voice-mail systems are not. The Eastern Administrative Support Center has an Octel voice-mail system. The Mountain Administrative Support Center's telephones are managed by the National Institute of Standards and Technology (NIST) and not NOAA. NIST is reporting that the voice-mail systems are not Y2K-compliant. An upgrade is being ordered to take care of that. The Central Administrative Support Center resides in a GSA-controlled building and uses a switch owned by GSA. The Meriden key system is Y2K-compliant. The Norstar Voicemail was upgraded in 1998 to a model 8 for Y2K compliance. The Cisco 2501 router upgrade was purchased in September 1998 and the center is waiting on the contractor to install the upgrade. The fax machines and copiers are Y2K-compliant. One fax will require the date to be manually reset after January 1, 2000. The Western Administrative Support Center (WASC) telephone system (PBX) is owned by GSA and operated by US West. Certification has been received from both parties on Y2K compliancy. Upgrades for the voice mail system (Octel/Aspen model 4.12A) and fax server have been made and manufacturer certifications are on file. NOAA WAN and Internet connectivity is provided to WASC by other components within NOAA. These organizations are taking care of the certification of this equipment (routers) and related software/firmware. All the other telecommunications equipment (multiplexer, CSU/DSU, modems) has manufacturer certifications on file.

Motor Vehicles: Information received from the NOAA motor pool manager stated that the NOAA vehicle fleet should not have any Y2K issues. None of the vehicle vendors nor GSA have contacted that office with any concerns.

Data Exchanges: NOAA participated in the General Accounting Office (GAO) Government-wide survey of ingoing and outgoing data exchanges and identified 62 exchanges, of which 49 are with other Federal agencies, 7 with the private sector, and 6 with foreign governments. NOAA has a long history of standardized data format for data exchanges with its clients and partners. There were no system-to-system data exchanges that required Memoranda of Understanding with State and/or local governments. All contacts have been made with exchange partners and exchange formats are finalized.

Future Direction/Actions:

Outreach/Awareness: Through the NWS, NOAA continues to focus its Y2K-outreach efforts primarily through the American Meteorological Society and the World Meteorological Organization. It also holds user conferences and maintains electronic bulletin boards to exchange information and issues. NOAA also continues to participate in information gathering by the White House on its Y2K-outreach program. Information is being collected on NOAA contacts with the following sectors: insurance, emergency preparedness, environmental protection, and

science and technology. NOAA is represented on the cross-cutting Emergency Preparedness and Environmental Protection working groups being chaired by the Federal Emergency Management Agency (FEMA) and the Environmental Protection Agency (EPA) respectively. An NWS emergency-preparedness outreach plan addressing the private meteorology sector is complete. NWS and NESDIS are members of the NWS' Office of Federal Coordinator for Meteorology-affiliated Special Action Group(SAG) for Y2K testing. Other members are the Naval Oceanographic Command, the Air Force Weather Agency, and the FAA. The SAG members participated in successful system interface tests with all clients and partners in late January and early February 1999. A final Y2K end-to-end test is scheduled for late March 1999 and may include the United Kingdom.

Independent Verification and Validation (IV&V): NOAA continues to evaluate its IV&V requirements. NOAA will use a combination of in-house Quality Assurance Teams, outside contract support, and, where possible, DOC or Office of Inspector General validation processes. NOAA has recommended most of NWS' and NESDIS' systems for IV&V by the Department of Commerce contractors. Both NWS and NESDIS also will depend on the end-to-end test for much of its IV&V effort.

Business Continuity and Contingency Plan (BCCP): NOAA's BCCP has been completed and is undergoing testing to ensure business continuity. The plan will be updated periodically throughout the year as better information becomes available.

Assuring the Year 2000 Readiness of High Impact Federal Programs: In accordance with OMB instructions, the Department of Commerce and NOAA have the lead in ensuring the Y2K readiness of weather services. NOAA has developed an awareness plan, including milestones, and will be reporting against its progress monthly beginning in May 1999. A public event, including the possibility of a press conference to promote public awareness of NOAA's readiness in the weather arena, is being explored.

Y2K Performance Measures	FY 99	FY 00	FY 01
% of Mission-Critical Systems Y2K Compliant (out of 117 systems)	100	100	-
% of Mission-Critical Systems covered by the NOAA Business Continuity and Contingency Plan	100	100	-

Y2K Milestones	FY Goal
Renovation of Mission-Critical Systems Completed	FY 99
Validation of Mission-Critical Systems Completed	FY 99
Implementation of Mission-Critical Systems Completed	FY 00

Y2K Milestones	FY Goal
Independent Validation and Verification Completed	FY 00
NOAA Day-One Planning Completed	FY 00

Cost Estimates ($K): Most Y2K-related costs are associated with system maintenance efforts and are not included in the estimate below, which represents the additional funding NOAA requested to address this issue.

Issue	FY 99	FY 00	FY 01
Y2K	10,682	0	0

Contact Point: John O'Brien (301-713-3345, x 107)

Information Technology Architectures

Description: There is increasing awareness that IT systems need to operate within an integrated environment. Systems often need to interact as they are used to accomplish different but related parts of the NOAA mission. Decisions about hardware and software are best made with a common understanding about the computing environment in which they will be used. The GAO and OMB have emphasized that an underlying system architecture is required as part of the planning necessary for all IT budget initiatives.

Status: NOAA is not attempting to develop one comprehensive architecture that would cover the entire organization and everything it does. Centralized architectural efforts are being focused on shared technologies used throughout the organization or on key technologies that need to be coordinated. NOAA is moving to the use of a single enterprise e-mail system. NOAA's Network Advisory Review Board has issued a policy document, the NOAA Interoperability Profile (NIP), to provide a standards-based approach to networking that ensures that systems can interoperate, and it has developed a NOAA policy on the use of the Internet. A draft networking architecture has been developed to support NOAA's Information Services Delivery initiative. Standard COTS security software is also being implemented on a NOAA-wide basis. A team is at work on developing a NOAA-wide architecture for the use of High Performance Computing and Communications systems and technologies. The majority of NOAA's architecture development, however, is taking place at the Line Office level or for specific programs within a Line Office.

The GAO and OMB have stressed the requirement to develop a NWS architecture. The NWS is complying with this requirement by developing a Weather System Architecture. The Weather System Architecture will provide an organizational structure of the system's components, their interrelationships, and the principles and guidelines governing their design and evolution over time. The technical infrastructure architecture will provide a top-level view of a system's communications and networks, processors and platforms, and operating systems and support software and services. The technical architecture will describe in terms of its component's

features or services, standards profiles, performance, capacity, security, and geographical distributions.

The NWS has completed a draft Requirements Generation Process Policy (Dec. 10, 1998). "This document establishes the policy and process for the generation/approval and prioritization of requirements for the National Weather Service." This policy institutes a review board at both the national and regional levels for the identification of requirements at the local, regional and national levels. The policy divides Operational Requirements into two parts. Part A is the Mission Needs Statement that articulates a specific need . Part B is the Requirements Analysis and Solution section that outlines possible solution, impacts, and cost estimates. The amount of detail in Part B will be determined by the submission level, and validation and approval will be done by the Regional Director or Assistant Administrator as appropriate. The draft policy is in the process of a trial implementation. The projected trial period will extend through July 1999.

The NWS has instituted a corporate review for all initiatives. The corporate review is the next step from the Requirements Generation Process. The corporate review process provides an integrated framework for evolving, maintaining, and acquiring new information technology to achieve the agency's strategic goals. The corporate review occurs each year in conjunction with formulating and submitting a budget. The corporate review consists of Regional Directors, Office Directors, the Assistant Administrator, and the CFO reviewing the status of current budget initiatives and proposed budget initiatives. Part of the review process is the screening of initiative compliance with Strategic IT goals. Initiatives both new and ongoing are examined for their fit within the overall framework of the NWS.

The National Marine Fisheries Service is implementing its enterprise Fisheries Information Technology (FIT) architecture, which provides an IT Principles-centered framework for managing technology change and has been described in previous Plans. Funding is now the principle handicap preventing full implementation of the architecture.

Within NESDIS the efforts are being approached differently. The NOAA National Environmental Data Archive and Access System Project, which is replacing and building upon the NOAA Virtual Data System (NVDS), is establishing an architecture for the data centers to allow on-line access and support electronic commerce for NOAA data and information. This will build upon the architecture developed for the NVDS. Outside users will see one access point and system, regardless of the data center involved. The Satellite Active Archive has developed an open-systems architecture based on scientific workstations and near-line robotic storage coupled to an enterprise server. The NESDIS Central Environmental Satellite Computer System (CEMSCS) has a distributed-processing architecture, and each satellite ground system has its own architecture.

NOS has also approached most of its architectural efforts on the basis of individual programs, such as nautical charting, geodesy, etc. It is also participating, however, in the NOAA-wide efforts concerning e-mail, Information Services Delivery, and high-performance computing.

Within OAR, in June 1998 the Geophysical Fluid Dynamics Laboratory (GFDL) released a first version of the GFDL IT Architecture Plan, including a Technical Reference Model and a Standards Profile. This plan described GFDL's mission and products and outlined the current and target architectures in terms of work, information flow, applications, and technology views. A gap analysis was conducted which identified several key changes, opportunities, and upgrades anticipated in the transition to the target architecture. This plan will be used and upgraded as part of the upcoming procurement planning process. It will also be valuable as input for the NOAA High Performance Computing Study that was initiated during the past winter.

Future Direction/Actions: NOAA will continue to develop and implement IT architectures and coordinate with any Departmental efforts covering Department-wide resources or requirements.

Contact Point: Ira Grossman (301-713-3345)

Information Technology Security

Description: IT security in NOAA is a broadly-based, decentralized program that relies on Line and Staff Office participation, partnership, and enforcement. The objective is to protect the integrity, availability, and confidentiality of NOAA's sensitive systems and data, including approximately 350 sensitive systems for which security plans have been developed. Dedicated staff resources include one full-time NOAA IT Security Officer (ITSO) within the Information Systems Office (ISO) of the Office of Finance and Administration (OFA), supported by other OFA staff and part-time Line Office ITSOs. System administrators and managers also have defined roles and responsibilities along with their other duties.

The nature and complexity of security threats are increasing due to dynamically expanding use of networks to accomplish program objectives, and there are insufficient technical staff and resources to maintain continuity of important initiatives. NOAA's ability to perform its mission as a scientific information agency has grown as a direct result of these technological changes, but at the same time, as the business model shifts to one built on remote automated information dissemination, the criticality and complexity of protecting online resources has also increased. The sort of corollary security responsibility that has been NOAA's model of operation in the past is no longer viable in many circumstances. Improperly configured and maintained host systems can be compromised and provide hackers with internal network configuration information and specifics concerning users. The introduction of firewall technology reduces the risks associated with mis-configuration.

Statutory requirements for this program are derived from the Computer Security Act of 1987, (Public Law 100-235); the Office of Management and Budget Circular A-130, "Management of Federal Information Resources"; and the A-130 Appendix III, "Security of Federal Automated Information Resources." NOAA Administrative Order 212-13, "Information Technology Security Management," explains the roles and responsibilities of individuals and organizations involved in computer security within NOAA.

In addition to the formal requirements dictated by OMB, the program is based on security-awareness training and information dissemination, risk assessments, formal security site reviews, corrective actions, and technical support. The core of OMB requirements applies to each system and includes a formal security plan, risk analysis, disaster recovery planning, system accreditation, and verification reviews. Security awareness training is provided through new employee and manager training, seminars, publications, including an annual bulletin, and conferences. Information dissemination includes: topical workshops, a NOAA Security Web page, security alerts, quarterly meetings among security officers, coordination with other Federal agency security officers, and publications such as the "IT Security Planning Guide." Risk assessment and corrective actions occur through formal site reviews and independent technical evaluations (e.g. the Lawrence Livermore Laboratory). To further support these activities NOAA has assembled suites of software for protecting systems (commercial anti-virus and risk-analysis software, public domain Internet tools), and performs periodic security assessments of critical systems.

NOAA has taken the initiative to develop a software product that will facilitate creating and maintaining security, contingency, disaster recover plans, risk assessments, and tracking IT security requirements. ISO is promoting the software within the larger DOC security community in an effort to widen the support base and decrease NOAA costs.

Status: The principal success measure for computer security in NOAA is the degree of awareness and commitment exhibited by its systems administrators and end users; i.e., detecting and reporting incidents, network monitoring, and corrective actions for technical or operational controls resulting from security assessment reviews. Although that commitment is hard to quantify, there have been a number of noteworthy accomplishments:

- ISO has established a NOAA Computer Incident Response Team (N-CIRT) with NASA Automated Security Incident Response Capability (NASIRC). NOAA users are able to view the NASIRC page for news, services, policies, references, security organizations, and alerts.

- NOAA's Network Operations Center's (NOC's) firewall is in place. Networks will be placed behind the firewall when the network administrator requests it and a required written agreement for each network behind the firewall is completed. Two networks have been moved behind the firewall at the first level of security.

- As part of the N-CIRT, the NOAA NOC will perform, by request, scans on all NOAA's networks. Scanning will automatically be performed on networks behind the firewall to find vulnerabilities within the systems.

- The NOC has installed an Intrusion Detection System (IDS) and is using it routinely to guard the three Washington-area Internet connections. The IDS has produced a large volume of data indicating external threats. The NOC notifies local systems administrators when there is significant evidence of intrusions. These alerts increased levels of awareness and commitment.

- ISO developed a modular security handout as minimal guidance for the NOAA Silver Spring Trusted Campus Network.

- ISO completed draft policy guidance for using firewall technologies in the Washington Metro area and throughout NOAA.

- ISO completed draft security rules or system-specific policies. Rules will be based on various system users' needs. The rules will delineate responsibilities and expected behavior of all individuals having access to the system. Rules are required to be in writing and will form the basis for security awareness and training.

- ISO coordinated an N-CIRT Workshop December 10-11, 1998. Presentations covered the NASA IT Security Program, Allied Technology Group Technical IT Security Operational Capabilities, NOAA/NASIRC Roles and Responsibilities, NASA/NASIRC Automated Systems Incident Response Capability, Incident Handling, Communication, Training, and NOAA's Standard Operating Procedures.

- ISO conducted a two-day firewall policy workshop June 10-11, 1998.

- ISO participated with the National Security Agency (NSA) to conduct security assessments. NSA performs these reviews at no charge and has been conducting reviews for NOAA for the past seven years. These reviews assure that management, operational, and technical controls are appropriate and functioning effectively. NSA's findings and recommendations for each assessment have been very useful, and corrective actions were taken to implement the findings.

- The NOAA-wide anti-virus software, VirusScan, supports DOS, Windows, and NT. VirusScan no longer supports Macintosh; Virex software does. Network Associates has agreed to provide Virex software free until the VirusScan license expires in November 1999.

- Quarterly ISO prepares and publishes NOAA's security awareness bulletin, *Frontline*, as a security awareness training tool.

- ISO procured Security Tools 2000 (ST2000) to develop automated security plans, Disaster Recovery Plans (DRPs), risk assessments, and a management tracking system for NOAA's IT Systems. Two four-day training classes on the ST2000 were provided for NOAA security officers and system administrators.

- ISO implemented an automated ADP Security Incident Form for all NOAA employees to report intrusions and viruses automatically to the NOAA IT Security Officer (ITSO) and the appropriate Line Office ITSO. The NOAA Form 47-43 is located on the NOAA IT Security Web Page, which also contains information on security alerts, security news updates, laws, regulations and policies, UNIX host and network security tools, anti-virus software, the security planning process, and miscellaneous documents.

- NOAA completed eight security-assessment reviews for the Office of Oceanic and Atmospheric Research and the National Weather Service in Norman, Oklahoma; Newport, Oregon; Seattle, Washington; Princeton, New Jersey; and Camp Springs, Maryland.

- A NOAA working group has been formed to plan a Public Key Infrastructure (PKI) for encryption. When this is implemented, its first application will be secure messaging for use by IT security personnel, including systems administrators. Later this effort will expand to include a general secure messaging facility for NOAA.

- An Emergency Action Card and a Fingertip Guide for incident response are being drafted for distribution throughout the agency. The NOAA Security Policies and Guidelines are being developed. They will include sections on incident handling, rules of behavior, security responsibilities, etc. The NOAA Administrative Order (NAO) 212-13, "IT Security Management," and a document on "Computer Incident Response Guidelines" are in pre-publication review. The automated Security Incident Response Form is being revised by NASIRC to match their database.

Future Direction/Actions: In the future the elements of NOAA's Security Architecture will include: a Virtual Private Network (VPN); a secure messaging environment; guidelines for system protection, including tools, precautions, and methodologies; implementation and coordination of firewalls; and the NOAA Incident Response Team, which in addition to coordinating incident response will act as a source of expertise and information regarding vulnerabilities and responses in NOAA's environment.

As NOAA gains experience with the firewall at the NOAA Headquarters campus in Silver Spring, additional networks will be moved behind it and some will move to higher levels of security behind it.

NOAA's future plans for other requirements of the revised OMB Circular A-130 are to:

- Develop the NOAA Computer Incident Response Team.

- Develop more training classes for security officers and network administrators on the ST2000 software, different operating systems, and reporting and detecting incidents.

- Evaluate and further develop policy guidance regarding the use of firewall technologies throughout NOAA.

- Further develop security rules and system-specific policies based on system owners' and various system users' needs.

- Continue to use the National Security Agency (NSA) for conducting security assessments of NOAA's critical systems. So far, seven sites have been scheduled for 1999.

IT Security Performance Measures	FY 99	FY 00	FY 01
Number of networks protected by firewalls	15	35	50
Number of networks protected by IDSs	300	400	500
Number of users with secure messaging	0	40	300
Days of training for systems administrators et. al.	20	40	50
Locations with VPN capability	3	5	10

Security Milestones	FY Goal
Washington-area firewall policy	FY 99
NOAA security conference	FY 99
National firewall policy	FY 00

Contact Point: Rebecca Vasvary Gaujot (301-713-3333, x133)

High Performance Computing

Description: NOAA requires high performance computing capabilities (HPC) to perform its mission. HPC is currently critical to weather forecasting, seasonal climate prediction and long-term climate research. There are emerging requirements for HPC in areas as diverse as fisheries simulations, hazardous spill response and data mining. Therefore, NOAA has initiated a study to identify and document the full range of current and projected research and operational requirements for high performance computing, to identify and analyze alternative NOAA-wide computing/networking architectures that can meet these requirements, and to develop recommendations relative to implementing these alternatives. Special attention will be given to the possible consolidation of high performance computing facilities.

Status: The Deputy Under Secretary directed the Office of High Performance Computing and Communications (HPCC) to conduct an HPC Study using a NOAA-wide team augmented by outside expertise. The study team has been formed and held an initial series of meetings. Subgroups are hard at work establishing the vision, principles and objectives for high performance computing in NOAA, developing a baseline description of NOAA assets and HPC usage, surveying NOAA HPC requirements, documenting technology trends, and reviewing alternative practices of other organizations with similar high performance computing needs.

Future Direction: Several key issues have already been identified for close examination. Perhaps the most important issue is back-up for the National Centers for Environmental Prediction (NCEP). An second issue that maybe critical to full support for NOAA requirements is the possible use of another high-end facility on a shared basis. Finally, a full understanding of the performance and cost trade-offs of remote use of HPC for research is critical to the success of this study.

HPC Milestones	FY Goal
Preliminary Report - Initial description of the current HPC baseline, HPC requirements over the next 3-7 years, technology trends over the next 3-7 years, and conceptual alternatives for providing NOAA HPC capabilities including in-house assets and use of external resources.	June 1999
Interim Report - Complete description of the current HPC baseline, HPC requirements and technology trends over the next 3-7 years and alternatives for meeting those requirements.	September 1999
Final Report - Evaluation of alternatives and decision package for NOAA senior management	January 2000

Cost Estimates ($K):

Issue	FY 99	FY 00	FY 01
HPC	200,000	0	0

Contact Point: William Turnbull (301-713-3573)

Critical Infrastructure Protection

Description: As an information agency, NOAA is on the cutting edge of both the benefits and risks associated with the great Cyber explosion of the 90's. The Presidential Decision Directive 63 (PDD-63) recognizes that these risks can, in fact, thwart the Agency's basic mission and provides a template to facilitate on-going efforts to protect those resources.

In response to PDD-63, NOAA has developed an initial Critical Infrastructure Plan (CIP) that identifies NOAA's Minimum Essential Infrastructure (MEI) and lays out a plan for assuring that they are adequately protected. The plan complies with the Vulnerability Assessment Framework developed by KPMG Peat Marwick in these ways:

- Identification of MEI,
- Data gathering to Identify MEI Vulnerabilities, and

- Analysis and Prioritization of vulnerabilities.

Booz-Allen & Hamilton is reviewing the MEI identified by NOAA as part of an Independent Validation and Verification effort for which the Department has contracted. In parallel with the BAH effort NOAA is completing Vulnerability Assessments of the NOAA-identified MEI. In the second quarter of FY2000 NOAA will develop a "gap analysis" to correct weaknesses described in the Vulnerability Assessments .

While some of these weaknesses may require considerable investments in order to provide redundant systems, programs already in place are going a long way toward protecting the existing infrastructure.

Status: The efforts underway to protect NOAA's existing infrastructure include:

- Identification of MEIs,

- Coordination of IT security with Critical Infrastructure Protection developments,

- Planning for NSA-conducted training classes for NOAA and DOC security officers on how to perform vulnerability assessments in accordance with PDD-63,

- Plans for NOAA and NSA to perform vulnerability assessments in accordance with PPD-63 on seven of NOAA's critical MEI systems from April-November 1999.

- Installation of three Intrusion Detection Systems (IDS) that run at each Internet gateway in the Washington metropolitan area to provide information about suspicious network activity that might be characteristic of an intrusion or other malicious incident, such as a network probe. These systems are not fool-proof and they miss some hostile attempts while reporting other events that may not represent an intrusion at all.

Future Direction: In the future, the following activities will be undertaken:

- Continued use of NSA for conducting Vulnerability Assessments on NOAA's minimum essential infrastructure systems.

- Assessment of electrical requirements for critical systems in the Silver Spring center that would have to continue operating during a two-day or two-week electrical utility outage.

- Development of an engineering plan and cost estimates for the electrical requirements that will be used for both Y2K preparation and a permanent power backup system.

- Implementation of intrusion detection systems in other NOAA locations.

- Development of Disaster Recovery Plans, security plans, and risk assessments for each MEI system using the ST2000 software.

- Management assistance in analyzing MEIs, identifying strengths, weaknesses, and external dependencies.

- Creation of the CIP-required Disaster Recovery Plan for both cyber and physical invasions (a business function plan for all operations), Risk Assessments, and Security Plans.

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- Promulgation of the in-place IT operations mechanism to serve as a model for business functions.

- Provision of information required by PDD-63 regarding NOAA's MEI that would benefit from using an IDS that would network managers with the ability to better and more proactively detect potential problems, and coordinate and respond to them.

- MEI system managers' identification of functions and locations of systems that will require protection within the first two years. (Each system that has an individual access to the public network or to another outside private network should be considered as requiring an IDS. Systems that are not connected to the public network, and/or are within a private network, will not require this protection.)

Critical Infrastructure Protection Performance Measures	FY 99	FY 00	FY 01
Number of networks protected by firewalls	15	35	50
Number of networks protected by IDSs	300	400	500
Number of users with secure messaging	0	40	300
Number of MEI vulnerability assessments conducted	7	7	7

Critical Infrastructure Protection Milestones	FY Goal
Washington-area firewall policy	FY 99
Identification of MEI systems	FY 99
Identification of electric power requirements	FY 99
National firewall policy	FY 00

Critical Infrastructure Protection Milestones	FY Goal
Installation of backup power generators	FY 00
Complete vulnerability assessment of MEI systems	FY 01

Contact Point: Rebecca Vasvary Gaujot (301-713-3333, x133)

Commerce Administrative Management System (CAMS)

Description: CAMS is a Department-wide effort to modernize and integrate its financial and administrative management systems and streamline related business processes. The goal of CAMS is to employ modern technology to provide managers with standardized, accurate, and timely information to manage their resources while at the same time reducing administrative costs. Additionally, CAMS will be compliant with the Joint Financial Management Improvement Program (JFMIP) requirements for financial systems. A fuller description of CAMS, performance measures, milestones, and system costs are provided in the CAMS report in the chapter on "NOAA-wide Infrastructure Capabilities".

Status: An extensive Independent Verification and Validation (IV&V) study was conducted by Booz-Allen & Hamilton to analyze the NOAA CAMS strategy, schedule, and the associated budget/resources required to successfully implement CAMS, as well as the technical architecture and capabilities of the existing NOAA hardware and software. Based on the final IV&V report, senior NOAA and DOC management conducted extensive discussions about modifying the NOAA CAMS schedule, combining the NOAA CAMS Program Office with its major stakeholder, strengthening its technology support, and reducing implementation risk. The specific measures decided upon are detailed in the CAMS report in the chapter on "NOAA-wide Infrastructure Capabilities".

Future Direction: The NOAA Deputy Under Secretary directed that the NOAA CAMS Program Office elongate the implementation schedule to fit financial constraints. The result would be a fully deployed CAMS at the beginning of FY 2002.

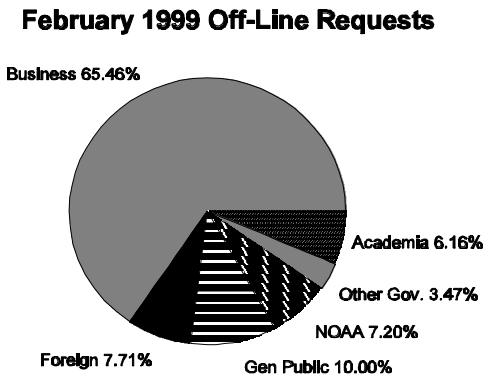
In February of 1999 the Department's Assistant Secretary for Administration and Chief Financial Officer formally asked the Department of Interior (DOI) if a cross-servicing agreement with NOAA was feasible and at what cost. DOI uses the financial management system developed by American Management Systems (AMS). DOI responded to the Department's inquiry by requesting that a series of meetings with NOAA CAMS personnel be scheduled to determine the exact nature of NOAA's functional and technical requirements, and to see if there is a fit with the services they could provide. These meetings are currently underway. If a proposal is made by DOI, NOAA will evaluate their proposal based on cost, functionality, and technical aspects in comparison with CAMS software.

Contact Point: Millie Ingels (301-427-1100, ext. 117)

Data and Information Management

Description: NOAA collects, processes, stores, and disseminates environmental data and information products produced from these data. The wide range of customers served by NOAA is illustrated by the accompanying chart showing the wide range of customers served by NOAA data, including businesses, the general public, and academia.

NOAA operates three National Data Centers, the National Climatic Data Center (Asheville, NC), the National Geophysical Data Center (Boulder, CO), and the National Oceanographic Data Center (Silver Spring, MD), that are responsible preserving, managing, and disseminating environmental data. Other parts of NOAA manage equally important but less voluminous quantities of data.



The National Data Centers must be capable of: ingesting the new data that NOAA continuously collects, rescuing data previously collected but in danger of being lost, retrieving the data upon request, and managing the transition of the data as storage technologies change.

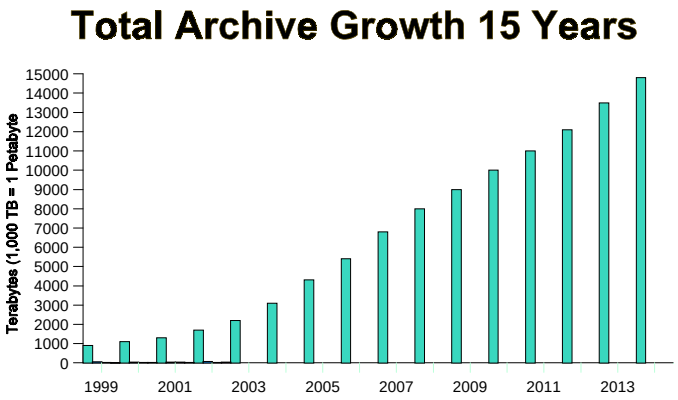
NOAA is in the process of preparing a report to the Congress on the status and challenges for NOAA's environmental data systems. This report, The Nation's Environmental Data: Treasures at Risk, providing a detailed account of the data and information management problem facing NOAA , will be available soon.

Status: Technological advances have enabled the collection of increasing volumes of environmental data. NOAA's new sensors, including satellites, radars, and automated surface observing systems, are collecting massive amounts of data. NOAA's digital archives are expected to grow to almost 35 times their 1998 volume over the next 15 years. By 2003 NOAA will be expected to archive more data in one year than was contained in the digital archive in 1998. The expected increase in volume of NOAA's data archive between now and 2015 is shown in the chart titled, "Total Archive Growth 15 Years".

Demand for data is also growing. With increased usage of the Internet and electronic mail, users are demanding on-line ordering and on-line search and browse capabilities with electronic data delivery. NOAA has worked to meet this demand through the NOAA Virtual Data System (NVDS) and NOAA Server projects.

In summary, NOAA faces a two-pronged problem, enormous quantities of new data to manage and enormous numbers of new users to serve. Plans are being developed to rapidly expand the data storage capacity at the Data Centers and automating the means of data ingest, quality control, and access.

Future Direction: In FY 1999 and FY 2000 NASA will be delivering to NOAA heritage satellite data sets, including the Upper Atmosphere Research Satellite (UARS), Total Ozone Mapping System (TOMS), and the Solar Backscatter Ultraviolet (SBUV) data sets. The requirement for NOAA to archive these data was agreed upon in October 1998 during the National Science Foundation Workshop on Global Change and Science Requirements for Long-term Archive and Data Continuity. Data that was managed at the NASA Goddard Space Flight Center on a short-term basis is being transferred to NOAA for permanent archiving.



However, the future requires that new investments be made in NOAA data management infrastructure. Within NOAA's strategic planning structure the Implement Seasonal to Interannual Climate Forecasts and Predict and Assess Decadal to Centennial Change strategic teams are considering funding proposals for the FY 2001 budget request. Without an infusion of additional funds NOAA is faced with two undesirable choices: (1) giving up by throwing the data away and partially wasting the investment that was made to collect the data, or (2) storing the data in boxes even though it would be virtually inaccessible and would require a substantial future investment to eventually "rescue".

Contact Point: Susan Zevin (301-457-5113)

NOAA INFORMATION TECHNOLOGY PLANS ORGANIZED BY NOAA'S STRATEGIC PLAN GOALS

The following section is arranged by the goals established by NOAA's Strategic Plan. Under each goal individual information technology systems are addressed. These systems were selected for one or more of the following reasons: (1) they are major information technology systems essential for meeting a strategic goal, (2) they are expected to be the focus of a budget initiative, (3) they are major systems or systems development projects at or near a key decision point in their life cycle, and/or (4) they are major systems with outside interest. Some systems support more than one goal. In these cases they will be addressed in the primary goal being supported and cross-referenced under the other goals.

For each system this plan provides a general description of the system, its role in achieving the NOAA strategic goal, and its general plans. Performance measures for the system's support of the program and milestones for key future actions are included. Budget estimates are provided at the end of each goal's section. These estimates are for only the IT portion of the system, and reflect the money necessary for the related hardware, software, maintenance, services, support services, and personnel costs (as defined by OMB Circular A-11). Both base funding and proposed budget initiative funding are included. The figures for FY 2000 are from the President's budget, while the figures for later years are ones to be included in NOAA's FY 2001 budget request to the Department of Commerce.

STRATEGIC GOAL: ADVANCE SHORT-TERM WARNING AND FORECAST SERVICES

The Programmatic Goal and Objectives: NOAA's vision for 2003 is to provide significantly improved short-term warning and forecast products and services that will enhance public safety and the economic productivity of the Nation. NOAA will enhance its ability to observe, understand, and model the environment, and effectively disseminate products and services to users. The four major objectives of this goal are: to maintain National Weather Service (NWS) Modernization Operations, to maintain satellite continuity, to enhance observations and predictions, and to improve service communication and utilization. Forecasts of environmental conditions depend upon the acquisition of massive amounts of data and the ability to quickly run prediction models using these data. Advances in these areas are dependent upon improvements in information technology and its use. The modernization and restructuring of NWS is dependent upon the successful implementation of information technology systems. The primary Line/Program Offices involved in this goal are NWS; the National Environmental Satellite, Data, and Information Service (NESDIS); the Office of Oceanic and Atmospheric Research (OAR); the National Ocean Service (NOS); the Coastal Ocean Program Office; and the Systems Acquisition Office (SAO).

Performance Measures: The IT systems described in this chapter collectively contribute to the accomplishment of the performance measures set for this strategic goal. While additional measures will be shown for specific systems, it is impossible to separate the contributions of individual systems towards achieving the overall goals. The overall measures are provided here to show how modernization investments will benefit the public.

Advance Short-Term Warning and Forecast Services Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Tornado warning lead time (in minutes)	11/10	11	12	13	13	14
Tornado warning accuracy (%)	67/65	70	72	74	75	76
Severe thunderstorm warning lead time (in minutes)	18/18	19	20	21	22	23
Severe thunderstorm warning accuracy (%)	84/84	84	85	86	87	88
Flash flood warnings lead time (in minutes)	52/40	42	44	45	45	45

Advance Short-Term Warning and Forecast Services Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Flash flood warning accuracy (%)	83/83	85	86	86	87	88
Severe Coastal Event warning accuracy of landfall (km) w.24 hour lead time	140/ 140	135	130	130	125	125
Precipitation forecasts lead time for 1" precipitation (days in advance)	2.3/2.3	2.3	2.4	2.4	2.5	2.5

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.
**This is based on a small number of events (1) so this number may not be representative of the accuracy that can be routinely achieved.

Advanced Weather Interactive Processing System (AWIPS): The Advanced Weather Interactive Processing System (AWIPS) is a technologically-advanced information processing, display, and telecommunications system that is the cornerstone of the NWS modernization and restructuring. AWIPS is an interactive computer system that will integrate all meteorological and hydrological data, and all satellite and radar data for the first time, and enable the forecaster to prepare and issue more accurate and timely forecasts and warnings. Through the implementation of AWIPS, the NWS will meet its mission "to provide weather and flood warnings, public forecasts, and advisories for all of the United States, its territories, adjacent water and ocean areas, primarily for the protection of life and property" more efficiently and effectively. It is a key element of the "maintain NWS Modernization Operations" objective under the "Advance Short-Term Warning and Forecast Services" goal of NOAA's Strategic Plan.

AWIPS is a key element of the modernization of the Weather Service. Deployment of the systems has been approved and will be completed in FY 1999. Continued improvements to the systems are planned.

AWIPS consists of an integrated suite of automated data-processing equipment that will be deployed to field offices and National Centers (the National Centers for Environmental Prediction, the Office of Systems Operations, the Hydrologic Information Center, the National Operational Hydrologic Remote Sensing Center, and the NWS Training Center) to support complex analysis, interactive processing, display of hydro-meteorological data, and the rapid dissemination of warnings and forecasts in a highly reliable manner. A Wide-Area-Network will connect sites for multi-point-to-point and point-to-point communications. NOAAPORT provides the

communications capability, via a satellite broadcast network, to afford internal and external users open access to much of NOAA's centrally collected and produced real-time environmental data. Efforts have been undertaken to ensure the AWIPS hardware platforms and supporting communications infrastructure can accommodate planned future development.

The AWIPS program is capitalizing on recent advances made in relevant technologies. The AWIPS development and deployment employ an incremental, evolutionary build approach where functionality is developed and implemented in multiple stages, thus allowing more frequent integration and evaluation of system components and realization of benefits as rapidly as possible. The initial increment is being fielded with the target architecture and will form the basis upon which future increments necessary to replace the aging Automation of Field Operations and Services (AFOS) system and streamline program operations will be integrated.

The AWIPS site architecture is an Open System implementation. The use of open systems has been a key aspect of the AWIPS design and will continue to influence design and implementation decisions. This approach has resulted in a standards-based, client/server system that provides isolation of applications, data, and system-level functions from hardware implementation and software services to eliminate dependency on vendor-unique products. The system architecture emphasizes the use of commercial-off-the-shelf (COTS) hardware and software, and functional independence of components to deliver a system that is flexible, expandable, and portable. This approach maximizes the intended long-term life of the system.

The AWIPS program is deploying systems concurrently with the incremental development in order to minimize schedule risk. Deployment can proceed independent of development. The most recent build will be retrofitted to already deployed sites; new sites will be deployed with the newest build.

Planning is underway for system evolution activities once the acquisition is complete. These activities will ensure (1) that AWIPS will continue to provide improved mission support capabilities which take advantage of advances in hydro-meteorological science and technology, and (2) that AWIPS technology does not become antiquated or non-maintainable and keeps pace with marketplace technologies.

AWIPS will benefit the operations of the NWS by:

- Providing computational and display functions for operational NWS sites,
- Providing open access, via NOAAPORT, to extensive NOAA datasets that are centrally collected and/or produced,
- Acquiring and processing data from an array of sensor systems (e.g., the WSR-88D radars, ASOS, and GOES) and local sources,
- Providing an interactive communications system to interconnect NWS operational sites and to broadcast data to NWS sites,

- Disseminating warning and forecasts in a rapid, highly reliable manner, and
- Making the transition from the existing AFOS and to restructured operations.

In particular, AWIPS will provide several service-related capabilities and integration of data at a level not now available through current systems. AWIPS will provide:

- Collection, processing, and display of data via one system;
- Integration of all critical data sources, e.g., radar, satellite, observations, and models;
- Single, integrated forecast operations with interactive analysis of data and forecast preparation;
- The ability to "drive" the NOAA Weather Wire Service and local dissemination circuits and automated NOAA Weather Radio;
- The ability for one Weather Forecast Office (WFO) to back up a second WFO that experiences system failure;
- The capability to acquire directly local data sets;
- Access to WSR-88D data from non-associated radars in order to not miss events; and
- The capability to ensure consistency of warnings and forecasts over multi-WFO areas.

System Status and Plans - During FY 1998, the Secretary of Commerce, William Daley, certified to Congress that the program could complete the deployment of 152 baseline systems and develop and test AWIPS software adequate to commission AWIPS and decommission the AFOS system within the Congressionally-mandated funding cap. On April 9, 1998 the Secretary approved full-scale production and deployment of the associated AWIPS hardware at Key Decision Point (KDP) IV. The Government and prime contractor reached agreement on a schedule to complete the baseline system deployment by the end of June, 1999. AWIPS Build 4.0 was completed in May 1998. By the end of FY 1998 a total of 60 AWIPS systems had been installed and accepted on schedule.

Prior to the KDP-IV decision, the Secretary directed that action be taken to strengthen the management and control of the AWIPS program. The following management changes were implemented in FY 1998 in response to this direction: (1) the NWS program management organization and the NOAA acquisition management organization were consolidated under the leadership of the Program Manager, (2) NWS matrix personnel dedicated full-time to supporting the AWIPS program were detailed to the program office and placed under the direct control of the Program Manager, and (3) a formal program control function was implemented to collect metric data and track progress against baseline plans. Significant changes to the software

development process were also implemented, including: (1) placement of all software-development resources under the technical direction of the AWIPS System Engineer; (2) development of new code within a common configuration management environment; (3) field testing of new functionality prior to, and during, formal system testing; and (4) forging of a synergistic integration and test team of Government and prime contractor personnel.

Through the end of FY 1998, all program indicators point toward completion of the commissioning software build and full scale production/deployment of 152 systems within the $550M cap. The prime contractor and Government have demonstrated the ability to sustain accelerated production and deployment rates necessary to finish in June, and the development risk continues to diminish with each successive month we remain on schedule.

Deployment of all AWIPS systems and development through Release 4.2 will be completed by June 1999. Commissioning of AWIPS systems should commence within the six months following deployment of Release 4.2.

To realize the greatest benefit from the investment in NWS modernization, and to fully realize significant performance improvements in short term warning and forecast services, AWIPS must continue to evolve to provide effective integration with other NWS systems; to provide forecasters with the full range of data sets available from NWS modernization systems (e.g., WSR-88D, ASOS, satellites, and guidance forecasts from the Class VIII supercomputers); and to enable forecasters to effectively and efficiently interpret the wealth of data available. Activities planned for FY 2000-2005 include:

- Capabilities planned for Build 5, as verified in an independent assessment conducted in FY 1998, will be developed and fielded in a series of releases to be completed in FY 2001. Key capabilities included in AWIPS Build 5 are decision support through the System for Convection Analysis and Nowcasting, initial National Center and non-CONUS WFO unique functionality, interactive forecast preparation tools, and the inclusion of full NEXRAD Principle User Processor (PUP) functionality on AWIPS.

- AWIPS hardware changes will be supported in order to maintain currency, both in technology and mission support, of the nationwide AWIPS hardware platform. Specific items designated for replacement or upgrade between FY 2001-2005 are initially deployed applications servers, LAN Hubs, data server storage, workstation storage, and local interface connection support.

- Beginning in FY 2001, the program will put in place facilities to provide protection of the AWIPS network against catastrophic failure from the loss of an identified single point of failure, as recommended in the 1997 NRC assessment of AWIPS. This will include providing an alternate Network Control Facility, alternate satellite Master Ground Station, a back up for the satellite transponder, and redundant access circuits in the terrestrial communications system.

- Development plans for FY 2001-2005 include providing for more efficient methods of data transmission, storage, and retrieval on AWIPS. These efficiencies are critical in order to address the tremendous and ever-expanding quantity of data produced by NOAA/NWS observing systems and numerical forecast models, and to minimize software maintenance costs. Plans include implementation of the results of existing AWIPS data-modeling studies to develop an integrated database of static and dynamic and hydrometeorological data; incorporation of commercial data management and storage solutions (e.g., Geographic Information Systems), and implementation of new data-compression technologies.

- Between FY 2000-2003, the AWIPS program will effect a Local Area Network (LAN) interface between AWIPS and the WSR-88D, by designing, developing, and testing and implementing a hardware/software solution to connect the AWIPS and WSR-88D LANs at each NWS site. This will enable each site to provide high-speed, large-volume data transfers in a secure manner, allowing NWS to take advantage of rich spatial and temporal information embodied in the radar base data. Further, this capability will provide the necessary communications infrastructure to allow advanced radar information derived from new capabilities, such as dual-polarization (which uses signals polarized into alternating horizontal and vertical orientations and compares the returns to provide better discrimination of precipitation type and size), to be used on AWIPS and by other government and external users.

- Continued evolution of AWIPS includes building on common software used by all NWS sites (e.g., WFOs, River Forecast Centers) and creating unique extensions required by National Centers and off-CONUS offices. A study conducted in FY 1998 has shown that the current AWIPS architecture can support an effort that unifies the design for all AWIPS sites. Development in FY 2001-2003 will accommodate additional data sources, enable display of data over larger domains and at higher resolutions, and provide a suite of graphical editing tools and grid-editing functions. Development in FY 2003-2005 would incorporate advanced data visualization displays and model editing tools.

- An AWIPS initiative beginning in FY 2001 will provide for the design, development, and testing of a suite of applications which will implement decision assistance tools for WFOs and National Centers. There is a critical need for applications which allow NWS forecasters to sift through the tremendous volume of data available on AWIPS and focus attention on the most critical existing or developing weather events. In FY 2001, activities will begin to implement a suite of decision-assistance tools for aviation and marine hazards similar to the successful prototype System for Convection Analysis and Nowcasting (SCAN) package that has been developed for application to severe weather and flash floods with the short-term forecasting function.

- In FY 2001 increases to the communications bandwidth on the AWIPS communications network will be made and sustained on a recurring basis. Changes include an increase in bandwidth of the AWIPS Wide-Area-Network (WAN), an increase in bandwidth of the AWIPS Satellite Broadcast Network (SBN), and establishment of connectivity of

Department of Defense (DOD) radar sites to NWS. The increase in SBN bandwidth will allow output from advanced numerical models (run on new Class VIII supercomputers) to be made available to NWS field forecasters. WAN bandwidth increases will allow more radar and gridded forecast coordination data to be shared among NWS field sites and support the central collection of radar data. Connection of DOD radar to NWS will provide equal access to data from these critical radars.

Performance Measures - AWIPS contributes to the accomplishment of the performance measures set for the strategic goals of the NWS. The overall performance measures shown for the NWS show how the modernization investments will benefit the public. The performance measure shown below is for the deployment of AWIPS.

AWIPS Performance Measure*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
AWIPS installed**	43/42	92/84	0/9			

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.
** The number of sites shown does not include the 17 that were installed as part of the AWIPS Development Phase prior to FY 1998 and before limited and full production decisions were made.

AWIPS Milestones*	FY Goal
Nationwide deployment decision	FY 98/FY 98
Complete Nationwide deployment	FY 99/FY 00
Complete development/test of commissionable software	FY 99
Complete WAN upgrade	FY 99
Complete development of AWIPS Build 5	FY 01
Complete implementation of catastrophic backup protection	FY 01
Complete SBN upgrade	FY 01
Complete implementation of LAN interface to Open RPG	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

The National Centers for Environmental Prediction: The National Centers for Environmental Prediction (NCEP) serve as America's primary source for information on the future behavior of our physical environment, including changes in the weather, oceanic conditions, climate variations, and fluctuations in the near-space environment. The NCEP uses sound scientific techniques to convert environmental observations into projections of future conditions that affect our society. In doing so, the NCEP leads the Nation in combining scientific and technological advances to provide the best possible forecasts of our physical environment to meet the daily needs of the American people.

NCEP produces environmental forecasts and warnings. The Class VIII supercomputer has been procured. Periodic upgrades will be needed to improve the ability to assimilate more data and integrate improved models.

NCEP comprises nine centers, and while each center has a specific responsibility for a portion of the NCEP products and services suite, they all work together. Seven of the centers provide direct products to users, while two of the centers provide essential support through the development and operational use of complex computer models of the atmosphere. The task of developing and running these models to make timely environmental predictions requires enormous computing power, so the IT resources of NCEP include supercomputers and powerful scientific workstations. NOAA periodically upgrades the NCEP high-end computing capabilities to improve its capacity to assimilate increasingly rich data from satellites, radar, and other sources, and to run more detailed, higher-resolution models. All of this effort is directed toward improving the accuracy of the Nation's environmental predictions.

The activities associated with the use of high-performance computing at NCEP support NOAA's strategic goals to "Advance Short-Term Warning and Forecast Services" and to "Implement Seasonal to Interannual Climate Forecasts". One of the implementation objectives under these goals is to strengthen prediction systems. In order for the public to fully benefit from the other aspects of the modernization of the NWS, NCEP needs IT resources that can handle the increasing quantity of environmental data and integrate the improvements in meteorological research in a way that results in better forecasting. Increased prediction accuracy for hurricanes, severe thunderstorms, floods, winter storms, seasonal to interannual climate variation, etc., has a significant economic impact on the Nation.

The IT architecture at NCEP is fully described in the NCEP Information Technology Plan (March, 1995). Essentially, that architecture is open, heterogeneous, and multi-tiered. Within it, systems employ a common UNIX operating system, communicate via TCP/IP Ethernet, and exchange information using standard data formats.

System Status and Plans - In October 1998 the Department of Commerce awarded the NWS/NCEP high performance computing contract to the International Business Machines (IBM) Corporation. The following month, IBM began installation of the RS/6000 SP system in Federal Building 4, at the Suitland Federal Center in Suitland, Maryland. No fiscal year 1998 funds were expended on this system. Extensive facilities work was required to accommodate this system

including asbestos abatement and the replacement of the raised floor. It was necessary for IBM to make hurried repairs to the facility in order to maintain the implementation schedule as described in the contract.

Immediately upon installation of the Early Access System, NCEP staff began the task of converting computer codes from the Cray C90 system. An important factor in this conversion process was the work done earlier on some of the most demanding codes which were used as benchmarks during the competitive acquisition process. The conversion effort is in progress as of this writing (March 1999). The difficulty of this conversion effort to date has been less than anticipated, with many codes porting to the IBM system with little or no change. NCEP expects the IBM RS/6000 SP to become operational as scheduled, during the spring and summer of 1999. Key decision points regarding these plans will occur in April and June. The acceptance tests for the RS/6000 SP occur in April with acceptance anticipated on April 30. Following that point, the next critical decision point is in June when NCEP will assess the progress made to that date in the migration of operations to the IBM system. NCEP will determine in June whether or not it will be necessary to further extend the lease on the Cray C90 system.

In order to implement an operational, integrated suite of climate forecasts, NCEP has submitted an initiative designed to augment the high performance computer system (NCEP High Performance Computer for Implementation of Operational Integrated Suite of Climate Forecasts). Through this initiative, NCEP seeks additional computing capacity for the Class IX system. With this augmentation the Class IX will substantially advance climate predictions and support the linkage of climate forecasts to the assessment of risks due to extreme weather events such as floods, droughts, hurricanes, and fire weather over periods from 1 to 2 weeks in the future out to seasons in advance. NCEP will accomplish this by implementing an integrated operational suite of weather and climate forecasts using advanced, scalable, and coupled atmosphere, ocean, land and hydrological models supported by a state-of-the-art data assimilation system. NCEP anticipates award of the Class IX contract in 2001.

The Class IX initiative includes several critical subsystems such as those for communications, interactive systems and maintenance/support. Maintenance and support of the Class IX system will be included in the system acquisition contract and both are augmented to extend support to the climate forecasting effort. Enhanced communications capabilities will support collaborative scientific research projects, both within NOAA and with developers elsewhere. Funds are requested to acquire the communications hardware and vendor services to support this collaboration as well as delivery of data throughout the operational forecast Centers within NCEP.

The request for funding for interactive systems acknowledges and takes advantage of the open, heterogeneous IT architecture employed at NCEP. It recognizes that the high-performance computing systems are not the most appropriate place from which to provide all IT services. NCEP intends to continue to utilize its scalable architecture by applying a range of resources to address a range of requirements. The most cost-effective manner in which to do this is to offer and support systems ranging from desktop workstations to departmental servers, in addition to the Class VIII and Class IX high-performance systems.

NCEP Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Hurricane Prediction System: 24 hour position accuracy (miles)	65/85	84	81	81	78	78
Mesoscale Precipitation Forecasting over N. America: threat score difference (x100) 12 mo. running mean compared to baseline[1]	7.1/7.1	7.4	7.7	8.0	8.3	8.6
Global Prediction System: 12 mo. running mean, 500 Mb height NH Anomaly Correlation, 5 day fcst[2]	76.4/ 76.4	77.1	77.8	78.5	79.2	79.7
Seasonal Climate Forecast, 3 year avg., 0.5 mo lead, Heidke Skill Score (Temp & Precip)[3]	23&12/ 23&12	22&10	22&11	23&12	26&14	29&16

The NCEP Performance measures have been extensively changed from last year's Strategic IT Plan. The new measures better reflect their basis in Numerical Weather Prediction and correlate with the performance measures used elsewhere. The numbers above must be considered with some sophistication. In most cases there is a great deal of inter-annual variability (or noise) that interferes with one's ability to note trends or improvements in these statistical performance measures over the short term.

[1]The threat score is a very strict measurement of precipitation forecast accuracy. The higher the threat score, the better the performance. The threat score based performance measurement used here compares two models. The higher the number, the greater the performance *improvement* of the new Mesoscale models.

[2]The Global Prediction System Anomaly Correlation is a measure of the accuracy of the forecast of atmospheric disturbances. It measures both the location and intensity of these disturbances. The number ranges from -100 to 100 (a perfect forecast). In general, a score of 60 is considered a useful forecast. As the number approaches 80, it becomes much more difficult to obtain improvement.

[3]The Heidke Skill Score is a measure of forecast skill ranging from 0 to 100 (perfect forecast). It measures the accuracy in probability forecasting in terms of improvement over random chance. The performance measure provided is a three year mean of both temperature and precipitation category forecast accuracy for a lead time of 0.5 months. Skill for FY 98 is very good because of the high predictability of the 1997/98 El Nino event. Because of the El Nino event, predictability was increased. Without an event such as El Nino, predictability is decreased.

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years.

NCEP High-Performance Computing Milestones*	FY Goal
Implement increased resolution of Eta model (from 48 to 32 km) together with 3D variational analysis	FY 98/FY 98
Implement direct utilization of GOES radiance data in global model	FY 98/FY 98
Implement direct utilization of GOES radiance data in regional model	FY 99/FY 98
Procure and install Class VIII supercomputer system	FY 99/FY 98
Complete test and evaluation of 4D variational analysis	FY 02/FY 98**
Implement 4D variational analysis	FY 03/FY 99**
Class VIII supercomputer fully operational	FY 99
Initiate Class IX supercomputer acquisition process	FY 99
Procure and install Class IX supercomputer system	FY 01
Implement 10 km Mesoscale Model	FY 01
Implement integrated suite of operational climate forecasts (T62)	FY 01
Class IX supercomputer fully operational	FY 02
Implement T254, 60-level global model	FY 03
Implement T126, 42-level climate forecast suite	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.
**4D variational analysis has proved to be more difficult that anticipated and is still in the research phase, so the milestones have been adjusted accordingly.

With the acquisition and installation of the Class VIII and Class IX supercomputers, NCEP will be able to operationally run numerical weather prediction models more frequently, at a finer grid spacing, at more atmospheric levels, and look further into the future. The following are some milestones relative to those scientific improvements.

Prediction Model Improvement Milestones	FY Goal
Hurricane Prediction System: 4/day, 18km, 18 levels, 72hrs →4/day, 8km, 36 levels, 120 hrs	FY 03
Mesoscale Prediction System (North America): 2/day, 48km, 38 levels, 48 hrs→4/day, 6km, 90 levels, 84 hrs	FY 03
Nested Mesoscale Eta Predictions (small domain): 1/day, 10km, 60 level west→4/day, 4km, 90 level, multiple	FY 03

Prediction Model Improvement Milestones	FY Goal
Short Range Ensemble Forecasting System: 1/wk, 15 member @80km→4/day, 60 member, 3 model@16km	FY 03
Global Prediction System: 126 waves at 28 levels→T254, 60 levels*	FY 03
Global Medium-range Ensemble: 17 members @T62/28→36 members @T126/42*	FY 03
Coupled Ocean-Atmosphere Forecast T40 Pacific Basin→T62Global Ocean**	FY 03/FY 01
System for Medium Range (5-15 day) Forecasts: Coupled Ocean-Atmosphere-Land Data Assimilation System Regional Climate Forecast Model (25-50 km)	 FY 04 FY 04

*Goal and milestone revised this year to be more realistic.
**Goal and milestone revised this year to a more ambitious goal with a later milestone date.

NWS Telecommunications Gateway: The timely, reliable, and accurate dissemination of weather observations and guidance products is the critical mission of the NWS Telecommunications Gateway (Gateway) operations facility. Delayed or garbled messages can result in the loss of life and property. The mission of the Gateway supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" and that goal's objective "to effectively disseminate products and services to users." Delayed or garbled information also negatively impacts the Department of Commerce mission of "...safeguarding the nation's economic infrastructure."

The NWS Telecommunications Gateway disseminates weather observations and guidance. A 3-year upgrade project has been completed. Future improvements will be needed to process a rapidly increasing volume of data.

The Gateway provides message-switching services to a national and international community of customers. Flood and storm watches and warnings, weather forecasts, observations, and short-range climate forecasts are distributed to NWS field locations, U.S. Government agencies (FAA, DOD, FEMA, DOA), foreign governments, and private commercial users. The Gateway services a national and international customer base in a near-real-time operational environment.

The operational system continues to evolve to a network-centric architecture which will accommodate the legacy channel-connected structure. The higher capacity switch-engine and servers were implemented to permit the Gateway to collect the ever-increasing volume of observations from new observing systems and to disseminate the more frequent, larger-volume, finer-scale centralized forecasts from the National Centers for Environmental Prediction (NCEP)

required for achieving the NWS modernization and restructuring and for improved national weather and climate forecasts.

In the past few years, dataset sizes have experienced explosive growth. NOAA's legacy systems were designed to handle datasets in the multi-Kilobyte-size. The Gateway is now required to routinely accommodate multi-Megabyte-size datasets, a thousand-fold increase. File Transport Protocol (FTP) is the method of choice for the efficient transfer of these large datasets but requires the TCP/IP protocol which runs on networks. The Gateway has been required to adopt a network-centric architecture to keep the Gateway evolution in step with the systems of customers who are adopting network communications as the standard medium of data exchange.

An allied trend is the adoption of the Internet as the communication system of choice by a wide variety of Gateway customers to obtain current information. The Gateway first began providing information on the World-Wide-Web in 1995. The data volume had risen to nearly 1,000,000 HTML pages of information retrieved from Gateway servers each day. Additionally, more than 28 Gigabytes of model output are provided each day to Intranet customers using FTP (including DOD, FAA, and other Federal, State, and local government agencies). The extrapolation of these exponential growth trends is hazardous at best.

System Status and Plans - During FY 1998, a new Gateway system was installed and it is now running IBM 9672 central switching systems and IBM RISC 6000 applications, data, and web servers to meet the data-distribution load anticipated with the new NCEP upgrade plan. The LAN in support of this operation has been completed and consists of both high speed FDDI, Fast Ethernet and Standard 10 Base-T Ethernet utilizing CISCO 7500 series routers and LAN hubs. The system has upgraded its firewalls and has achieved LAN connectivity to the AWIPS/Network Control Facility to increase throughput capability. Additional disk storage for both the central switching system and the server complex were installed in advance of anticipated loading of new products for the NWS field offices (to be delivered by AWIPS), FAA and other data users.

As a result of these increases in capability and increased user demand, the service provided by the Gateway was significantly improved during FY 1998 as demonstrated by the following metrics:

Measure	End of FY 98 Figure	Increase from FY 97
Average daily log-ins to FTP Server	59,000	738%
Average daily data downloaded from FTP Server	40.5 Gigabytes	810%
Average daily data uploaded to FTP Server	9.0 Gigabytes	900%
Daily median number of hits to IWIN Server	1.2 million hits	40%

Measure	End of FY 98 Figure	Increase from FY 97
Average non-IP Data Traffic Input/day into the NWSTG	1.2 Gigabytes	20%
Average non-IP Data Traffic Output/day from the NWSTG	1.6 Gigabytes	10%
Increase in overall server (Internet and FTP) storage capability		100%
Increase in overall server (Internet and FTP) processing capacity		600%

The implementation of the NCEP super-computer and the central collection of the NEXRAD data are expected to result in a significant increase in data volume that is to be processed by the Gateway. The characteristics of the datastreams are not yet known and therefore the effect on the Gateway cannot yet be assessed. The assessments are planned for completion for NEXRAD by the end of January 2000 and for NCEP beginning in January 2000. When the assessments are completed, the need for funding for increased capability will be evaluated. Increases in capability will likely include additional disk storage, connectivity capacity increases in TCP/IP and FTP technology, server distributed architecture, and technology enhancements to incorporate additional capacity capabilities for increased data handling and switching.

Gateway Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Total volume of data handled through the switch per day (MB)	720/ 720	950	1,050	2,000	2,000	2,000
Total volume of data placed on the servers per day (GB)	50/50	100	150	200	250	300
Total volume of data retrieved from the servers per day (GB)	250/ 250	600	650	700	750	800

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

Gateway Milestones*	FY Goal
Installation of back-up system	FY 98/FY 98
Integration of software suites	FY 98/FY 98

Gateway Milestones*	FY Goal
Upgrade Network Servers	FY 98/FY 98
Implementation of Multi-casting	FY 99
Implementation of additional DASD	FY 00
Implementation of additional network servers	FY 00

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Next Generation Weather Radar (NEXRAD) System: The NEXRAD system is one of NOAA's prime observation systems for acquiring information about meteorological conditions. Based on Doppler radar technology, a typical NEXRAD system consists of three major subsystems: the Radar Data Acquisition (RDA) subsystem, the Radar Product Generation (RPG) subsystem, and the Principle User Processor (PUP) subsystem. The RDA subsystem transmits the radar signals into the atmosphere. The RDA then receives the returned radar signal from precipitation and other targets and processes this "raw" radio frequency data into representative digital information known as "base data". This base data is then transmitted to the RPG subsystem over either hardwire, fiber optics, or microwave, depending on the radar's location. The RPG takes the base data, and using its computational power and resident algorithms, manipulates and processes the data into various weather "products" (wind velocity, precipitation, etc.). The product data is then passed, upon forecaster request, to the PUP, where it is converted into a visual representation of the digital data, and presented to the forecaster.

NEXRAD is NOAA's Doppler weather radar system. Upgrades to processing subsystems are needed to increase the benefits being obtained from the system and to reduce its costs.

One of the objectives of the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" is the the enhancement of the observations needed to make warnings and predictions. NEXRAD is one of the key systems in NOAA's modernization and restructuring. By using Doppler radar technology, forecasters can observe the presence of precursor conditions of severe weather such as tornadoes and violent thunderstorms. NEXRAD allows for the detection of wind circulation patterns (e.g., mesocyclones) as precursors to tornadic activity and provides data on the direction and speed of tornado cells once they form. NEXRAD also provides quantitative estimates of area precipitation, which are important in hydrologic forecasting of floods and in water resource management. The severe weather and storm wind field detection capabilities offered by NEXRAD have contributed to a significant increase in the accuracy and timeliness of NWS warnings. Nationwide implementation has increased tornado warning lead times from the pre-NEXRAD average of 5-6 minutes to 15-20 minutes for strong tornados (strength F3 or higher) while reducing false warning rates. The advantages of NEXRAD over conventional

radars can be broken down into five basic areas: improved sensitivity, improved resolutions, wind velocity estimation, automated volume scanning, and capability for scientific processing of data.

The future benefits of this system are currently limited by the original proprietary hardware and software and the complicated nature of the software architecture, which make it very costly to maintain and evolve the system. Furthermore, the limited expansion capacity of the system's design prevents optimal use of weather radar data within the modernized Weather Forecast Offices (WFOs) and National Centers. Advances in the analysis of hydrometeorological weather radar data continue to be made, but not all can be implemented with the existing system. A planned product improvement program has been established to address these concerns with the IT systems and the need for increased functionality. The NEXRAD Product Improvement (NPI) Program was established to plan and implement continued improvement of the NEXRAD system to meet NOAA's strategic goal to "Advance Short-Term Warning and Forecast Services" for the general public, meet FAA requirements for additional and higher quality products, and meet DOD requirements for a radar products platform interoperable between NEXRAD and other DOD weather systems.

The primary goal of the NPI Program is to modify, augment and improve upon the existing capabilities of the NEXRAD system so it can support, in a cost-effective and timely manner, known operational requirements, as well as those requirements that can reasonably be anticipated. The NWS, working in partnership with OAR, is developing two major upgrades to the NEXRAD radar system. Initially major efforts are being expended in the RPG and RDA data and signal processing areas. The National Severe Storms Laboratory (NSSL) is leading an effort called the Open Systems RDA/RPG, which involves moving the proprietary NEXRAD hardware and software functionality to UNIX-based, open systems architecture. The second upgrade is to the Doppler technology itself. NSSL will improve the way the Doppler signal is transmitted and processed, resulting in Dual Polarized Doppler radar. Significant improvements should be achieved in estimating the amount of rainfall and identifying precipitation types (frozen vs. liquid).

Note: In order to meet agency-unique requirements, each of the tri-agencies has a separate upgrade to the PUP in development; Weather and Radar Processor (WARP) for the FAA, Advanced Weather Interactive Processing System (AWIPS) for the DOC, and Open PUP (OPUP) for the DOD. Only the DOD OPUP activity is considered a part of the NPI Program. Since it will be managed by the NWS, it is included in the budget estimates even though all of the OPUP funding is being provided by DOD.

System Status and Plans - The fourth of five planned Open RPG (ORPG) software Mini-Builds was completed in December 1998. Hardware selections have been made, and procurement activities for test and limited production equipment have begun. The ORPG software development is anticipated to be finished in FY 1999, with formal testing and field testing to extend into FY 2000. Full-scale deployment of ORPG is scheduled for the fourth quarter of FY 2000. Full scale deployment of ORPG is scheduled for the fourth quarter of FY 2000, with completion in FY 2002.

The Open RDA (ORDA) development is at an earlier stage; system design and individual components have been completed but integration work has just begun. ORDA deployment is scheduled for FY 2002 - FY 2004.

NEXRAD Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Time needed to make algorithm upgrades[1]	18/ 18 mo.	18 mo.	18 mo.	12 mo.	6 mo.	6 mo.
RPG AWIPS data flow	56/56 Kbps	56 Kbps	56/10 Mbps	10 Mbps	10 Mbps	10 Mbps
RPG processing capacity (SPEC-Marks)[2]	5/5	5	60	60	60	60

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

[1] Faster algorithm upgrades speed up the process of transferring scientific advances to operational use.

[2] Increased capacity allows the implementation of a greater number of algorithms and more sophisticated algorithms on the system.

NEXRAD Milestones*	FY Goal
Complete open RPG Build 1 software	FY 99
Complete development of open RPG hardware and software	FY 99
Begin limited production phase field deployment of open RPG	FY 00/FY 99
Complete deployment of open RPG	FY 02/FY 01
Complete development of open RDA	FY 01
Begin limited production phase field deployment of open RDA	FY 02/FY 01

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Geostationary Operational Environmental Satellites (GOES) Ground System:

NOAA GOES provides hemispheric and local coverage for measuring meteorological data used in predicting, monitoring, and observing trends of weather. GOES satellites provide real-time weather data used to develop short-term weather forecasts. Data from the GOES satellites, combined with data from Doppler Radars and Automated Surface Observing Systems, greatly aid weather forecasters in providing better warnings of hurricanes, tornadoes, thunderstorms, winter storms, flash floods, and other severe weather. These warnings help to save lives, preserve property, and benefit commercial interests. Launches

The GOES ground system monitors and controls NOAA's geostationary environmental satellites. Upgrades are underway for future satellites.

are scheduled to replace aging satellites in order to maintain two operational GOES satellites in orbit at all times – one each at an eastern and western continental U.S. longitude. Depending on launch facility availability and economic factors, additional satellites may be launched into orbit at certain times and placed in either standby or storage mode, ready to replace an impaired or failed operational satellite. The last of the present GOES I-M series of spacecraft is scheduled for launch in 2002, with a new proto-flight instrument, the Solar X-Ray Imager (SXI). In FY 2002 the first of the next GOES series, N-O-P-Q, will be launched.

NESDIS operates the GOES satellites. All monitoring and control of the spacecraft is performed from the NESDIS Satellite Operations Control Center (SOCC) through 60-foot satellite antennas located at the Wallops Command and Data Acquisition Station in Wallops, Virginia. A Wallops Backup Facility, located at the Goddard Space Flight Center in Greenbelt, Maryland, will become operational in FY 1999. The Wallops Command and Data Acquisition Station (CDAS) also operates a shadow control system as a ready backup to the SOCC. The ground systems supporting the GOES spacecraft are divided into two parts: the GOES I-M Telemetry And Command System (GIMTACS) handles all health and safety checks and commanding of the spacecraft; and the Operations Ground Equipment (OGE) performs instrument data earth location, normalization, calibration, and quality monitoring, and spacecraft navigation. GIMTACS also interfaces with the OGE systems to create daily operational schedules. The daily schedule for each GOES consists of more than 5,000 commands to operate the spacecraft and its onboard instruments, and is executed from the GIMTACS system. There is a need to upgrade the GOES ground system to better handle storage and standby spacecraft, to accommodate the Solar X-Ray Imager instrument, and to prepare for the GOES N-O-P-Q series.

The IT architecture is a group of DEC Alpha servers (formerly designated superminicomputers) in a DEChub arrangement with workstations for the spacecraft controllers, schedulers, and engineering analysts also connected via the DEChub, and with complexes at the SOCC and CDAs interconnected via wide area networks.

This activity supports the NOAA strategic goal to “Advance Short Term Warning and Forecast Services” by maintaining satellite continuity and enhancing the capabilities to meet the objectives of a modernized NWS and to aid forecasters in providing more precise and timely forecasts.

System Status and Plans - The ground system must be prepared for the coming GOES N-O-P-Q series of satellites. The GOES Telemetry And Command System (GTACS), corresponding to the GIMTACS for the GOES I-M series, will be provided under the spacecraft contract, with an initial delivery in March 2000. Other elements of the ground system will be acquired by Office of Systems Operations/Office of Satellite Division. They include the OGE components SPS, Product Monitor, and Orbit and Attitude Tracking Subsystem. The Product Monitor used for GOES N-O-P-Q will actually be the Replacement Product Monitor currently under development. The GOES N Telemetry Acquisition and Command Transmission Subsystem (NTACTS) is the subsystem for N-O-P-Q satellites that corresponds to the subsystem used for the GOES I-M series of satellites. It also is being delivered under the spacecraft contract along with GTACS, but only for the Wallops Command and Data Acquisition Station. A dual-mission version of

NTACTS that can operate either with GIMTACS or GTACS will be developed for the GOES Wallops Backup at the Goddard Space Flight Center.

GOES Ground System Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
# of satellites in operation	2/2	2	2	2	2	2
# of satellite launches	0/0	1	0	0/1	2/0	0/1
# of satellites being maintained in standby/storage orbit	1/1	2	1	2	1	2

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GOES Ground System Milestones	FY Goal
Upgrade GIMTACS workstations	FY 00/FY 98
GOES L launch	FY 99
Replacement OGE product monitor becomes operational	FY 99
Wallops Backup at GSFC becomes operational	FY 99
GOES N-O-P-Q ground systems development begins	FY 00/FY 99
GOES M launch	FY 02/FY 00
Replacement GIMTACS TACTS becomes operational	FY 01
GOES N-O-P-Q ground system - installation and test	FY 03
GOES N-O-P-Q launches	FY 03 - FY 10/ FY 02 - FY 10

Forecast Systems Laboratory (FSL) High Performance Computing System (HPCS): As NOAA moves into the next decade, it will require substantial increases in computing resources in order to address its mission of describing and predicting the physical, chemical, and biological makeup of the earth and its environment. Massively-parallel processor (MPP) computers promise to provide the most cost-effective computer power available to meet requirements. Although many of NOAA's applications are ideally suited to a massively-parallel architecture, a substantial effort is still required to develop applications and procedures to make this transition.

The laboratory's Advanced Computing Branch (ACB) guarantees continued progress toward higher-resolution analyses and forecasts by porting FSL and NCEP models to MPPs, the

supercomputers of the future. To achieve the ports, the ACB developed the Scalable Modeling System (SMS) which significantly enhances the ability to develop parallel finite-difference weather models and provides source-code portability between a large subset of existing MPPs.

Currently, SMS has four components: the Nearest Neighbor Tool (NNT), the Scalable Runtime System (SRS), the Parallelizing Preprocessor (PPP), and the Scalable Spectral Tool (SST). NNT is a high-level library that can be used to parallelize regular grid weather prediction models. The requirements that were followed in the design and implementation of NNT are: portability of source codes and data files from workstations to massively-parallel computers; ease of programming; minimizing development costs; minimum impact to code appearance; fast performance on a wide variety of machines; and fast I/O operations. SRS is a support subsystem that provides scalable I/O and other system services. PPP is a Fortran source-to-Fortran-source translator that brings the features of NNT into directive (Fortran comment) form. SST provides support for numerical weather prediction models based upon spectral transforms.

Using DOC's CONOPS acquisition process, FSL is in the process of acquiring a High Performance Computer System to support the North American Atmospheric Observing System Program, continue development of the Scalable Modeling System, and collaborate with NCEP and others to develop the next-generation state-of-the-art mesoscale weather prediction model.

To date, SMS has been ported to the Intel Paragon; IBM SP2; Silicon Graphics Challenge, Origin; Sun Multiprocessor, Enterprise 10000; Hewlett-Packard Multiprocessor, Exemplar; Network of Unix workstations; DEC Alpha-based SMPs; Fujitsu VPP; and Cray T3E, YMP, C90, and J90.

FSL is in the process of acquiring a massively-parallel computer with peak speed of approximately 1 teraflop and a 15 to 30% improved operational efficiency for running finite-difference models of the atmosphere and ocean. Such a system, with significantly improved processing speed, will be made available as a resource to all of NOAA for developing and testing high-resolution models capable of depicting the detailed nature of weather systems, climate change, and ocean circulations. The system would serve as the technology platform for major NOAA developmental activities. Utilizing this new computer resource, FSL will

- Support the North American Atmospheric Observing System (NAOS) Program, taking the lead role in the scientific assessment of current and proposed future observing systems to define the most cost-effective mix of observing systems;

- Continue the development of the high-level software library, SMS, to ease the conversion process of software routines from the traditional shared-memory machine to massively-parallel scalable architecture; and

- **!** Continue to collaborate with NCEP and other organizations and university groups on developing the next-generation state-of-the-art mesoscale weather prediction model that will be used in both operations and research.

System Status and Plans - Using the Department of Commerce's CONOPS (Concept of Operations) acquisition approach, which focuses on dramatically streamlined processes, high performing and empowered work teams, early involvement and partnerships with vendors, and new uses of technology, FSL formed a cross-functional team to conduct the FY 1998-1999 acquisition of the HPCS, which includes requirements for a mass storage system (MSS), storage area network (SAN), applications and systems software, on-site training, on-site technical support, and hardware/software maintenance support. Core and associate team members include modelers, technical support staff, FSL senior managers, and contracting and legal staff.

Scheduled acquisition milestones, which began in June of 1998 with the Web posting of the Project Agreement, are currently in progress. As of March 1999, completed milestones are the issuance of the Request For Information (RFI) announcement in the Commerce Business Daily (Aug 98); the release of the Statement of Need, RFI, and initial benchmarks (Sept 98); RFI responses (Oct 98), oral RFI sessions (Nov 98), and market research; and, the release of final benchmarks (Dec 98) and the Request for Proposal (RFP) (Mar 99).

Remaining milestones are to evaluate vendor written proposals in response to the RFP, to conduct Live Test Demonstrations (LTD), and to evaluate the LTD results and final proposals. Award and subsequent delivery of the system is anticipated for the summer of 1999. System acceptance is expected in the fall of 1999, with operational status within 60 days after award (subject to agreement with selected vendor).

During FY 1998, FSL participated in the first phase of NAOS testing. The RUC2 (Rapid Update Cycle) model is running on a Cray at NASA/Goddard using a NAOS dataset that previously has run with NCEP's Eta model. Progress on this testing has been very slow due to competition for resources at NASA. Testing that should have taken weeks is already months behind schedule. It was also difficult to install the RUC2 suite in an environment that was unfamiliar to FSL staff. The procurement of the FSL HPCS will enable FSL (and other NOAA agencies) to more efficiently conduct NAOS testing.

FSL also continues to be involved with planning for NAOS and the Weather Research and Forecast (WRF) model. WRF planning is being coordinated with NCEP, NCAR and the university community.

Product improvements to SMS continued in FY 1998. The development of a new feature, the Scalable Spectral Tool (SST), was completed and added to the SMS suite. SST provides support for numerical weather prediction models based upon spectral transforms. Typically, spectral-based models use a combination of Fourier Transforms and Legendre Transforms. SST enables the efficient and portable parallelization of these models by allowing for logical processor transposes, index reordering for load balancing, and day/night and north/south load balancing.

During FY 1998, in concert with the FSL HPCS and Central Weather Bureau of Taiwan acquisition efforts, four new architectures are now supported by SMS. These architectures are the Sun E10000 server using Sun's implementation of MPI, the HP Exemplar using HP's implementation of MPI, clusters of Compaq (formerly) DEC Alpha-based SMPs using Compaq's implementation of MPI, and the Fujitsu VPP series using Fujitsu's implementation of MPI.

During FY 1998, two new models were parallelized using SMS. The Global Forecast System (GFS) from the is the first model to make use of the Scalable Spectral Tool (SST). This model was used by the Central Weather Bureau of Taiwan as a benchmark during their procurement. The in-house development of the Quasi Nonhydrostatic model was parallelized to enable testing at higher resolution and support FSL's HPCS acquisition.

FSL's acquisition of a HPCS will provide benefits in three major areas. The continued development of the SMS will enable scientists to better utilize MPP computers. SMS provides a programming environment that simplifies the porting of numerical models to the MPP environment. This should allow scientists to concentrate on the science of improving prediction systems.

Secondly, the HPCS will allow FSL and fellow NOAA scientists to continue their work to enhance NOAA's environmental prediction systems by providing a platform for development of environmental models. FSL will continue to collaborate with NCEP, NCAR, and the university community on the Weather Research and Forecast (WRF) model. WRF's focus is to develop an operational 5 km numerical model for the U.S.

Additionally, the HPCS will provide FSL and other NOAA entities a platform to perform testing for the NAOS project. NAOS focuses on testing existing and new observing systems in order to define the best mix of observing systems to be included in the observation and prediction systems of the modernized National Weather Service.

The development of better environmental prediction models will provide the basis for improved weather prediction products for the nation. With the HPCS, FSL will be able to continue its multi-faceted developments toward that goal.

FSL MPP Performance Measures*	**FY 98**	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**
SMS improvements						
Annual # of new features released to the public domain	1/1	1	2	2	2	2
Annual # of new computer architectures supported	4/2	1	2	1	2	1
Annual % efficiency improvement	-	-	10	10	10	-

FSL MPP Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
NAOS Observing System improvements						
Annual # of observing system configurations evaluated	-	-	4	6	5	5
Develop (with others) a high-resolution non-hydrostatic community mesoscale model						
Annual # of additional applications capable of utilizing the new MPP	2/1	1	1	1	2	2
Run initial test of the dynamic model		2	3	2		
Run-time community mesoscale model (in percentage of forecasts length) on the new MPP	-	-	-	25	20	15

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FSL MPP Milestones*	FY Goal
Release RFI and evaluate proposals for MPP acquisition	FY 98/FY 98
MPP contract award, system tests, deployment	FY 99
Develop hardware and software infrastructure to support SMS development, and NAOS and model testing	FY 99
Install SMS on the new MPP	FY 99
Begin work to run community mesoscale model	FY 00/FY 99
Begin extensive numerical modeling assessment activities for NAOS	FY 00
Release RFI for a new computer acquisition	FY 03

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National Space Weather Information System: The Space Environment Center (SEC) conducts research in solar-terrestrial physics; develops techniques for forecasting; provides real-time monitoring, alerting, and prediction of solar and geophysical events; and prepares data to be archived by NOAA's National Geophysical Data Center. SEC's Space Weather Operations (SWO) Division, operated jointly by civilian and U.S. Air Force staff, is the national and world warning center for disturbances in the space environment that can affect people and equipment. To support these activities, SEC and the National Geophysical Data Center operate computer systems to prepare and disseminate products based on the ingest, processing, display, and archiving of an increasing quantity of data. A distributed system of workstations and PCs, connected by a LAN, with multiple connections to the Internet is used. Dissemination of products is done by WWW, gopher, NOAA Weather Wire, and automated faxes, among others.

The National Space Weather System supports the monitoring and prediction of solar and geophysical events. Build 1 of the Information Dissemination System and the Data Display System has been successfully completed.

System Status and Plans - The Space Environment Center has successfully completed Build 1 of the Information Dissemination System and the Data Display System. These systems have demonstrated the value of CORBA (Common Object Request Broker Architecture) to implement distributed object architecture in a heterogeneous distributed environment. The expected completion of Build 2 of the Information Dissemination System has slipped from FY 1999 to FY 2000 because anticipated NASA funding did not materialize and delays associated with the planning for the SEC move to the new Boulder facility. In addition, the Rapid Prototyping Center has graduated one routine test product (the last step, to get customer feedback, before declaring the product "operational"), and another will go into routine dissemination every 15 minutes by summer 1999. Build 3 – to complete the core of the RPC software – will be completed in May 1999. With this core, resources are the only limit to how many research-grade models can make a transition to routine operations and become part of the suite of models run operationally at SEC. The database for images to flow from the Solar X-ray Imager on GOES-M in 2001 has been selected, and planning is underway, jointly between SEC and NGDC, to ingest, process, display, and archive these images.

Although major advancements have been made in recent years (e.g., without GEOSTORMS, the lead time for solar storm warnings will drop from 60 minutes to 0, and the accuracy for major geomagnetic storms drops from nearly 100% to less than 30%), NSWP needs to implement critical major program improvements. Five critical areas have been identified, based upon recommendations from customer/constituent feedback, the National Academy of Science, and the National Space Weather Implementation Plan.

To break the bottleneck preventing model transition, SEC will continue to build and implement the capabilities of the Rapid Prototype Center (RPC) to support model transition into operations. Major components include the Concept of Operations development, operational implementation, and the development and maintenance of hardware and software resources. SEC will also direct

model development research toward addressing operational requirements, through NSWP's Community Coordinated Modeling Center, Office of Naval Research MURI program, and NSF Science and Technology Center (proposed).

To get useful information to the forecasters, SEC plans to modify appropriate research mission spacecraft to transmit real-time data, acquire additional ground station (tracking) capability to receive all the available data, and develop data assimilation methods to make use of all helpful data streams regardless of their origin and format.

To promote the development of new and improved existing product lines, SEC plans to continue investing funding in GEOSTORMS 1 (data that indicates when a solar storm will hit the earth, and if so, its intensity) and develop a Communications and Navigation Signal Loss forecast and warning product line. The RPC will be used to identify and transfer the tools with the highest return in advancing existing geomagnetic and particle products and services and to develop algorithms that will automatically formulate and disseminate alerts, watches, warnings, and forecasts based on incoming data.

To ensure robust and user-friendly data archives the SEC, in collaboration with NGDC, will plan to increase capabilities to meet increased volume of GOES Solar X-ray Imager and GEOSTORMS data, and upgrade its systems to make access of that data seamless to the user.

To assure the utility of space weather products to customers, SEC will initiate new customer service efforts to ensure that the benefits of space weather forecast and warning products are being maximized, such as training on how to use SEC products; World-Wide-Web presentation of data, products, and tutorials; the development of products guides; documenting space weather impacts on NOAA satellite and ship operations; training operators of NOAA satellites and ships; attending trade shows and association meetings of adversely-affected industries; increasing the number of user workshops; and leveraging interagency education programs.

Space Weather Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Total # of products distributed annually via NOAA Weather Wire Service (baseline: 10/96)	14/14	12/16	14/16	14/17	15/18	16/18
Total # of annual products issued from RPC	1/1	2/4	4/6	6/8	8/10	10/12
Total # of major new data streams	1/1	2	3	4	4	4

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Space Weather Milestones*	FY Goal
Implement two new NSWP models and products using Advanced Composition Explorer (ACE) data	FY 98/FY 98
Implement modernized data acquisition, analysis, display and dissemination system (Build 2)	FY 00/FY 98
Complete the core of the RPC software (Build 3)	FY 99
Move all operations and systems to new building	FY 99
Upgrade National Space Weather Information System to allow analysis and numerical guidance to forecasters and customers	FY 99
Ingest, process, and display real-time images of aurorae from NASA's IMAGE satellite	FY 00
Begin program to develop mission (GEOSTORMS) to follow NASA's ACE in partnership with NASA and USAF	FY 00
Acquire real-time solar wind data from Triana	FY 00
Issue global maps predicting ionospheric variability for communicators and navigators	FY 01
Forecast radiation belt particle enhancements with improving lead-time	FY 01
Co-operate with USAF to implement ingest and processing of new solar x-ray data from GOES satellite	FY 01
First data from GEOSTROMS	FY 02
Issue regional maps, at higher resolution, predicting ionospheric variability	FY 04

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Central Environmental Satellite Computer System (CEMSCS): CEMSCS, operated by the NESDIS Office of Satellite Data Processing and Distribution, is NOAA's primary data-processing system for the Nation's environmental satellite data. CEMSCS ingests environmental data from NOAA's polar and geostationary spacecraft, and produces environmental products and parameters such as vertical atmospheric measurements (soundings), low-level wind vectors, and sea-surface temperatures. These data and products are critical inputs to NWS analyses and forecast models. The system is also used for satellite image production and serves as the host system for the digital satellite data archive (see the chapter on "Implement Seasonal to Interannual Climate Forecasts"). Although the primary uses for NESDIS polar-

orbiting satellite products are as inputs to the forecasts and warnings provided by NWS, these satellite data are also used in many other environmental information contexts by numerous Federal agencies, state governments, and the public and private sector. These uses include analyzing climate change; detecting volcanic eruptions and wilderness fires and tracking associated dust clouds; and monitoring the health of vegetation, the growth of deserts, and deforestation. CEMSCS also ingests and processes data from non-NOAA satellites to produce products to support protection, restoration, and sustainable use of coastal and oceanic ecosystems.

CEMSCS is the central processing system for environmental satellite data. Upgrades are needed to support new requirements and to deal with the Year 2000 problem.

CEMSCS has established a modern distributed-processing architecture to support the many different types of products that will be generated from the datasets created by new satellite systems (NOAA K-L-M-N-N', METOP, GOES I-M, ADEOS, Radarsat, and EOS). The CEMSCS architecture consists of powerful alternative platforms (i.e. servers and workstations) attached to an enterprise server in a client/server configuration. The enterprise server acts as a clearinghouse or traffic cop for data transfer to alternative processing platforms, as well as data and product distribution to a wide range of customers in the environmental studies, climatic research and meteorological communities world-wide. The primary computing platform is the Amdahl GS732 enterprise server using the Open Systems/390 (OS/390) operating system. An example of one of the alternate platforms is a Cray J916 processor which produces the Advanced TIROS Operational Vertical Soundings (ATOVS) from the advanced suite of instruments on the NOAA-15 satellite.

This activity supports the NOAA strategic goal to "Advance Short Term Warning and Forecast Services" by providing products from polar and geostationary satellites, enhancing the capabilities to meet the objectives of a modernized NWS, and to aid forecasters in providing more precise and timely forecasts.

System Status and Plans - The CEMSCS remains a viable operational production architecture for the current base-lined requirements. In FY 98 there was an upgrade of the two IBM mainframe computers (3090-17T and 9021-640) using the MVS operating system to the Amdahl GS732 enterprise server running OS/390 which represents an increase of 60% in processing power, as well as ensuring both hardware and operating systems are Y2K-compliant.

The Advanced TIROS Operational Vertical Soundings (ATOVS) product development for the new instruments on board NOAA-15 continues ahead of schedule. With the successful launch of the NOAA-15 satellite on May 13, 1998, operational implementation of ATOVS is scheduled for March 1999, 8 months ahead of original estimates. Development continues on a system to process and distribute, in near real-time, Moderate Resolution Imaging Spectroradiometer (MODIS) data from NASA's Earth Observing System (EOS) satellite, now scheduled for launch in July 1999. This system will also be used for processing data from future launches of this satellite series.

Several key issues need to be resolved this fiscal year. Clearer estimates on the launch of the joint NOAA/EUMETSAT Meteorological Operational (METOP) satellite are required to refine data processing requirements and system development schedules. In addition, more detailed information regarding non-NOAA instruments to be flown on METOP satellites is needed to improve resource estimates for data processing. Additionally, requirements for products from these instruments (Infrared Atmospheric Sounding Interferometer (IASI), Global positioning system Receiver for Atmospheric Sounding (GRAS), Advanced Scatterometer (ASCAT)) need to be identified and refined.

CEMSCS Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
% successful product delivery	98/90	90	90	90	90	90
Total annual # of Global Temperature and Water Vapor Profiles collected (M)	232/ 230	1430	3500	3500	3500	4500
Total annual # of Global Ocean Surface Winds products (M)	.05/.05	268	268	268	268	268
Total annual # of Satellite-derived Winds Profiles (M)	1.4/1.3	1.3	1.3	1.3	1.3	1.3
Total annual # of Satellite-derived Atmospheric Moisture Profiles (M)	101/ 100	500	500	500	500	500
Total annual # of Global Ozone Measurements collected (M)	1.1/1	1	1	1	1	1
Total annual # of Global Cloud Cover Images collected (K)	57/40	40	40	40	40	40
Total annual # of Satellite-derived Ocean Products (AVHRR Coast Watch) (K)	300/ 178	178	178	178	178	178

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

CEMSCS Milestones*	FY Goal
CEMSCS Mainframe Software/Hardware upgrade	FY 98/FY 98
ATOVS Software Operational for NOAA-K	FY 99
NASA EOS AM-1 products operational	FY 99

CEMSCS Milestones*	FY Goal
Second New Generation Satellite (NOAA-L) Products Operational	FY 00
NASA EOS PM-1 Products Operational	FY 00
ADEOS II Products Operational	FY 01
CEMSCS upgrades for METOP processing	FY 02
Cooperative European METOP Satellite Products Operational	FY 03
Next Generation NOAA-N' Products Operational	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Polar-orbiting Operational Environmental Satellites (POES) Ground System:

Satellite Programs - NOAA polar-orbiting satellites provide global and local coverage for measuring meteorological data used in predicting, monitoring, and observing trends of weather. Polar satellites provide real-time weather data used to develop short-term weather forecasts and to provide a continuous data archive for long-term climate studies ranging from the vegetation index to monitoring the ozone layer, and also to provide search and rescue services. Launches are scheduled to replace aging satellites in order to maintain two operational polar satellites in orbit at all times -- one crossing the equator at a morning local time, the A.M. satellite, and one crossing at an afternoon time, the P.M. satellite. Operational satellites are replaced by newly launched satellites when their instruments degrade to a substandard state or the orbit has drifted to an unacceptable nodal crossing time. The degraded satellites are left in orbit to provide SARSAT (Search and Rescue Satellite-Aided Tracking) and transponder services. At present, there are four polar satellites maintained in orbit, two of which are the operational satellites. The next POES launch (NOAA-L) is planned for February 2000 to replace NOAA-14, which will be 5 years old and has drifted to an unacceptable 3:30 p.m. nodal crossing. Building upon the POES program, an agreement is in place between NOAA and EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites) on the Initial Joint Polar System (IJPS). This program will include two series of independent but fully-coordinated NOAA and EUMETSAT satellites, exchange of instruments and global data, cooperation in algorithm development, and plans for real-time direct broadcasts. Under terms of the IJPS agreement, NOAA will provide the satellites for flight in the P.M. orbit and EUMETSAT will provide the satellites for flight in the A.M. All satellites will have a common core set of meteorological instruments. The METOP (Meteorological Operational) satellite will serve as the A.M. satellite for the U.S. civilian polar-orbiting mission. The first of the IJPS satellites, METOP-1, is scheduled for launch in FY 2003.

The POES ground system monitors and controls NOAA's polar-orbiting environmental satellites. System changes are needed to support convergence with other polar environmental satellite systems.

On May 5, 1994, President Clinton made the decision to merge the Nation's military and civil operational meteorological polar satellite systems into a single, national system; the Defense Meteorological Satellite Program (DMSP) and the NOAA satellite program will be converged into the unified National Polar-orbiting Operational Environmental Satellite System (NPOESS) with a first launch planned for the year 2007.

IT Requirements - NESDIS operates the NOAA POES satellites. This requires a complex ground system comprised of computers, RF receivers, bit and frame synchronizers, etc., at three sites. The IT architecture is a group of DEC Alpha servers (formerly designated superminicomputers) in a DEChub arrangement with workstations for spacecraft controllers, schedulers, and engineering analysts also, connected via the DEChub, and with complexes at the SOCC and CDASs interconnected via wide-area-networks. All monitoring and control of the spacecraft is performed from the NESDIS Satellite Operations Control Center (SOCC) through antennas located at the Fairbanks CDAS Station in Fairbanks, Alaska, and the Wallops CDAS in Wallops, Virginia. The Wallops CDAS also operates a shadow control system as a ready back-up to the SOCC. The POES Acquisition and Command Subsystem is the core telemetry and command system for NOAA polar-orbiting satellites. POES satellite operations are conducted on a schedule-driven, automated basis, with capability for operator intervention when deemed necessary. The onboard executing schedules are generated daily at the SOCC and are uploaded through the CDASs. In a first step to convergence, special-purpose components of the DMSP telemetry and command ground system have been relocated to the Suitland SOCC and incorporated into the Integrated Polar Acquisition and Command System (IPACS), an architectural expansion of the Polar Acquisition and Command System used for NOAA satellites. A similar IPACS configuration is installed at Schriever (formerly Falcon) Air Force Base, Colorado, to provide a backup to the IPACS at SOCC. A new Mission Planning and Scheduling Subsystem is under development for the operation of DMSP satellites as an early step toward convergence. To support METOP, the Fairbanks and Wallops CDASs will require new communications, archiving, and RF equipment peculiar to the METOP data format and radio frequency band; the Suitland SOCC will require new communications equipment to forward the METOP data streams to data processing systems.

A new ground system will be developed for the converged NPOESS satellites.

This activity supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" by maintaining satellite continuity and enhancing the capabilities to meet the objectives of a modernized NWS and aiding forecasters in providing more precise and timely forecasts.

System Status and Plans - The POES Acquisition and Command Subsystem is successfully operating the POES mission, having supported the launch of NOAA-K (15) and controlling the daily operation of the two primary operational satellites, NOAA-14 and NOAA-15, as well as operating secondary satellites providing some operational data used for some routine product generation, NOAA-11 and NOAA-12. It is also still monitoring NOAA-10 for SARSAT transmissions.

A POES Acquisition and Command Subsystem development system will be acquired for the development and testing of software changes needed to accommodate changes to instruments and operating scenarios. The Satellite Operations Management System will be enhanced to accommodate the monitoring and data downloads from the METOP satellites.

Polar Ground System Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
# of NOAA satellites in operation	2/2	2	2	2	2	2
# of DMSP satellites in operation	1/2	2	2	2	2	2
# of METOP satellites in operation	-	-	-	-	-	1
# of satellite launches	1/1	0/1	1/0	1	0	0/1
# of satellites being maintained in non-operational orbit	3/0	3/0	0	0	0	0

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

Polar Ground System Milestones*	FY Goal
NOAA-K launch	FY 98/FY 98
Mission Planning and Scheduling Subsystem operational	FY 99
Fairbanks DMSP-NOAA integrated system Initial Operational Capability	FY 99
Fairbanks DMSP-NOAA integrated system Final Operational Capability	FY 00
NOAA-L launch	FY 00
NOAA-M launch	FY 01
Fairbanks and Wallops METOP Initial Operational Capability	FY 02
METOP-1 launch	FY 03
NOAA-N launch	FY 04
NPOESS Ground System development contract award	FY 04
METOP-2 launch	FY 06

Polar Ground System Milestones*	FY Goal
NPOESS launch	FY 07
NOAA-N′ launch	FY 08/FY 07

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Research Systems: Improvements in NOAA's environmental prediction services critically depend on OAR research to improve NOAA observational systems, develop a better understanding of environmental processes, and enhance predictive models and dissemination systems in a comprehensive approach to natural hazard reduction. OAR research efforts support the design of the next-generation national observing system; improvements in hurricane track and intensity forecasts; enhancements to NEXRAD severe weather detection capability; extending forecasts accuracy out to a week or longer; and development of techniques to assimilate new data streams into forecast models. OAR develops strategies and advanced workstation demonstrations to speed critical weather information into the hands of decision-makers, and evaluates the effectiveness of weather and flood warning products and dissemination systems in meeting the needs of users of NOAA services. The Environmental Research Laboratories work in close collaboration with the operational components of NWS and NESDIS and in partnership with the NOAA joint institutes and other university scientists in the weather research focused on systems/modernization and forecasting.

Improving forecasts and warnings requires more frequent and higher-density observations, faster communications, and better local data-handling systems. Primary research activities include improving hurricane landfall predictions; filling data gaps and improving data assimilation models; and improving quantitative precipitation forecasts.

Improved Hurricane Landfall Predictions: The U.S. Weather Research Program seeks to improve both hurricane track and intensity predictions, as well as estimates of wind speeds at the surface at landfall and the flooding potential after landfall. Using improved data, for example dropsondes from the NOAA Gulfstream aircraft, and improved modeling capabilities from these more detailed data, the resulting better forecasts can translate into as much as $100M in reduced over-warning costs per occurrence.

The North American Observing System (NAOS): Under the NAOS program observing systems are developed, tested, and implemented to replace aging systems and to fill large data voids crucial to improving warnings and forecasts. Among the various IT activities required are the development of a research data hub to ingest observations from operational profiler sites, differential absorption lidars, and coastal profilers, and continued investigation of wind information derived from satellites. The latter will include the evaluation of lidar winds, validation of microwave winds, assessment of the forecast impact of these systems, and the specification of advanced weather and climate products.

Optimal Mix of Observations/Data Assimilation/Quantitative Precipitation Forecasting: The use of optimal observations along with improved data assimilation techniques will improve forecasts from a few hours in advance (watches) up to seven days to allow preparation for disruptive weather such as floods, severe winter coastal or continental storms, heat waves, or arctic outbreaks. IT plans in this area call for the enhancement and optimal use of WSR-88D radars through dual polarization techniques and enhanced processing, differential absorption lidars, upgraded wind profiler sites which include Global Positioning System (GPS) measures of water vapor, Aerodynamic Research Inc. Communication, Addressing, and Reporting System data sets, targeted observational experiments, and ensemble forecasting techniques. The use of optimal observations along with improved data assimilation techniques will improve forecasts from a few hours in advance (watches) up to seven days to allow preparation for disruptive weather such as floods, severe winter coastal or continental storms, heat waves, or arctic outbreaks.

Space Weather: NOAA is also the home of the World Warning Agency for Solar Storms. With society increasing its reliance on technologies vulnerable to space weather-induced failures (e.g. satellite communication and navigation systems and the electric power grid), the Space Environment Center is targeting IT resources toward the rapid evaluation and transition of new forecast observations and models into operations.

Within NOAA, research is conducted by many separate organizations in many different locations. These research organizations use a common computing architecture consisting of PCs and scientific workstations interconnected with high-speed networks to data and computing servers. The Internet is used to collaborate with colleagues at other research organizations.

Other Systems: The Automated Surface Observing System (ASOS) continues to be operated and maintained at sites across the country, with improvements made to meet changing user needs and decrease maintenance costs. Satellite Operations and Support Systems are required to support this goal, and will need to be upgraded on an incremental basis. The datasets of the Satellite Active Archive System, described in more detail in the "Implement Seasonal to Interannual Climate Forecasts" section, will support research in this area. Models produced by the Geophysical Fluid Dynamics Laboratory High Performance Computing Systems Division will also support this goal (see the "Predict and Assess Decadal to Centennial Change" chapter for details on the system). Those models include hurricane and severe storm prediction systems and, in cooperation with NWS/NCEP and the National Ocean Service (NOS), an operational coastal ocean forecast system.

The NWS has begun an effort to replace its current network of obsolete radiosonde observing systems. This network of 102 stations uses approximately 75,000 to 80,000 radiosondes annually in twice-daily releases. These balloon-borne expendable devices report temperature, humidity, pressure, and winds from earth's surface to an altitude of about 100,000 feet. The data are transmitted from the radiosonde to a ground-based system that receives the information and processes it into meteorological observations for distribution to data users. The replacement radiosonde system will be acquired in separate acquisitions. The radiosondes will be purchased in combination with a signal-processing unit for each site that will decode the proprietary signals

from the radiosonde into a standardized meteorological data stream which is passed to the Government's computer. The computer will be a Pentium computer running Windows NT, which will in turn be connected to the AWIPS local-area-network. For the past several years, development of the software for the Government workstation has been underway. The implementation of this software is planned in three stages: (1) replacing the IBM PC/XT currently used in the existing ground equipment, (2) attaching the new upper air workstation to AWIPS LAN, and (3) integrating the new radiosonde ground system. This supports a phased-in approach to implementing the replacement system equipment. Implementation of the new computers (interfaced to the current radiosonde ground equipment) would begin in FY 2000, and be completed in FY 2001.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 99	FY 00	FY 01	FY 02	FY 03
AWIPS	Development/ enhancement	67,667	22,575	26,729	13,100	11,843
	Steady state	12,189	38,002	44,967	45,945	46,223
NCEP	Development/ enhancement	0	0	5,720	7,405	7,185
	Steady state	30,125	31,623	31,531	31,540	31,755
NEXRAD	Development/ enhancement	5,720	7,520	14,526	10,716	11,531
	Steady state	6,992	7,858	5,870	5,615	8,742
GOES Ground System	Development/ enhancement	0	10,843	12,482	14,999	14,837
	Steady state	3,268	4,447	7,177	8,434	7,507

System		FY 99	FY 00	FY 01	FY 02	FY 03
NWS Gateway	Development/ enhancement	0	0	0	0	0
	Steady state	750	750	750	750	750
FSL MPP	Development/ enhancement	600	4,000	4,000	4,000	4,000
	Steady state	200	400	400	400	400
Space Weather	Development/ enhancement	1,420	1,470	2,600	2,800	2,800
	Steady state	1,510	1,560	1,800	1,900	2,000
CEMSCS	Development/ enhancement	2,700	3,700	2,000	3,500	3,700
	Steady state	8,900	9,300	9,700	10,300	11,000
POES	Development/ enhancement	560	3,295	3,558	6,467	2,126
	Steady state	3,788	3,999	5,008	5,431	5,354

Future Investments: Over the last decade the primary focus of NWS IT investments has been on a massive modernization of NWS systems. The NEXRAD, ASOS, and AWIPS systems have been developed. These systems either have been or are in the process of becoming operational. But because operational systems are not static systems, consideration is being given to the following as possible IT budget initiatives for the FY 2001 Budget Cycle:

NEXRAD - A product improvement program has been established to address the limitations caused by the original NEXRAD proprietary hardware and software and the complicated nature of the software architecture, which makes the system very costly to maintain. The program is currently funded at a level that will cause delays in completing open systems procurement and deployment, so NOAA may request additional funding so that the benefits of this program can be realized sooner.

AWIPS - A number of possible AWIPS-related initiatives are under consideration. The topics include the increasing of bandwidth of certain networks to provide more data to the field forecasters; to integrate the Open Radar Product Generator with the AWIPS site architecture to

provide NWS offices with more data; to design, develop, and test a suite of automated hydrometeorological decision-assistance tools for forecast offices; to improve data management components of AWIPS; to create extensions to the common AWIPS software to meet the needs of NOAA's national-level centers and sites outside the continental U.S.; and to implement a suite of decision-assistance tools for marine hazards that will form the foundation for the **S**ystem for **A**WIPS **F**orecasting and **E**valuation for **SE**as and L**A**ke**S** (SAFESEAS).

NCEP - Possible NCEP-related initiatives include: implementation of a new numerical weather prediction system; full implementation of an integrated suite of climate forecasts; development and implementation of a national capability to forecast the physical conditions of the coastal ocean (ocean currents, thermal, and water levels) in real-time over a period of a few days in the highly complex coastal environmental of the U.S.; and a technology infusion project that would provide efficient interfaces between the Environmental Modeling Center and the external scientific community, and more documentation about the modeling systems, with the objective of speeding progress towards improved numerical forecast systems.

NWR - The NOAA Weather Radio (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from a nearby NWS office. It broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day. Plans are being developed for a higher-quality concatenated voice technology to improve acceptance by the public. NWS plans to improve the computer-generated NWR voicing capability/quality used to broadcast warnings and short-fused watches generated by the Console Replacement System formatters.

AHPS - Advanced Hydrologic Prediction System (AHPS) forecast system software is being implemented nationally on River Forecast Centers (RFC) computer workstations, improving NWS's ability to issue flood and river forecasts with longer lead times and reduced levels of uncertainty. RFC hydrologists will use AHPS to produce hydrologic forecasts of river levels and river flows that extend from the current 1-3 days out to weeks and months, to provide river forecasts with uncertainty information for risk-based decisions, and to provide flood forecast maps for selected critical locations.

STRATEGIC GOAL: IMPLEMENT SEASONAL TO INTERANNUAL CLIMATE FORECASTS

The Programmatic Goal and Objectives: NOAA, working with academic and multi-national partners, will provide one-year lead-time forecasts of precipitation and surface temperature distributions. These forecasts will increase society's ability to mitigate economic losses and social disruption. The objectives set to accomplish this goal are to implement prediction systems, maintain and improve observing and data delivery systems, conduct research for improved climate predictions, deliver climate services, and assess socio-economic impacts. The primary Line/Program Offices involved in this goal are OAR, NWS, NESDIS, and the Office of Global Programs.

Satellite Active Archive: The NOAA Satellite Active Archive (SAA) is a digital library of near-real-time and historical satellite data from NOAA's Polar-orbiting Operational Environmental Satellites (POES) and other non-NOAA satellites. Data from the SAA support a broad range of environmental monitoring applications including weather analysis and forecasting, climate research and prediction, global sea-surface temperature measurements, atmospheric soundings of temperature and humidity, ocean dynamics research, volcanic eruption monitoring, forest fire detection, and global vegetation analysis. The system allows users to search an inventory database and browse selected datasets, preview sub-sampled Earth images of that data, and order the data for electronic delivery on the Internet or on computer-compatible media for further processing and analysis. The SAA services a wide user-base (other Government agencies, the private sector, academia, the secondary educational community, and the general public), thereby significantly improving NOAA's delivery of products and services to its customers. The SAA provides interoperability with the Internet (worldwide), the prototype NOAAServer, and Level 3 interoperability with the National Aeronautics and Space Agency's Earth Science EOSDIS (Earth Observing System Data and Information System) systems.

> The SAA is a digital library of near-real-time and historical satellite data. The system is operational. The amount of data available will be doubled and software will be upgraded.

The SAA supports NOAA's strategic goal to "Implement Seasonal to Interannual Climate Forecasts" by providing data for research in this area. Given the planned additional datasets, the SAA will also support most of the other six goals, especially to "Predict and Assess Decadal-to-Centennial Change" and to "Sustain Healthy Coasts".

The current SAA IT open systems architecture is based on scientific workstations and near-line robotic storage coupled to an enterprise server, the robotic storage being necessary to manage 6.4 terabytes of satellite imagery on digital tape media with an ongoing planned expansion to 60 terabytes. NOAA's goal for the next five years is to expand robotic storage to make 400

terabytes of data available electronically to customers. The workstations operating the system will also have to be upgraded to handle this volume of data. The open-systems architecture allows incremental additions to be made and the system to be located on one or several different processors at one or more locations.

System Status and Plans - The SAA is a fully operational system within the NOAA Office of Satellite Data Processing and Distribution (OSDPD) Information Processing Division (IPD). In calendar year 1998 the SAA electronically distributed over 1.5 terabytes of polar satellite data and derived data products to customers. In 1998 IPD made major upgrades to its hardware architecture that included the replacement of the central mainframe computer with a state-of-the-art enterprise server; the upgrade of the SAA robotic tape storage and retrieval system; and the replacement of outmoded SAA UNIX servers with state-of-the-art IBM SP/2 processors "closely coupled" to the enterprise server. Additionally, the SAA increased on-line storage capacity by 360 gigabytes with the acquisition of a high-capacity magnetic disk array for the placement of satellite browse imagery.

In FY 1998 the SAA began the implementation of new software systems which couple commercial off-the-shelf (COTS) relational database software with SAA-developed, object-oriented (OO) code to replace the then existing client-server operations. System Release 1.6 was the initial phase of the OO implementation and was coupled with the launch of and subsequent data distribution from NOAA-15. In FY 1999, Release 1.7 will complete the implementation of the OO software architecture, followed by Release 2.0 which will integrate the new IBM SP architecture to form the basis for polar satellite data distribution through 2003.

The IBM SP hardware architecture features high-capacity disk caching and networked data storage. The current configuration is scaled to 8 central processors and may be expanded to 32 processors. This increased processing and data-sharing capacity will reduce end-to-end processing and I/O time significantly, thus reducing time between customer data requests and actual data delivery. Additionally, the CPUs will be configured to provide total operational processing redundancy, thus eliminating any system downtime, providing uninterrupted customer access.

The near-term future of the SAA includes the expansion of near-line robotic storage to allow for the entire (1978-to-date) U. S. POES archive to be available for electronic distribution; an increase in processing capacity to keep pace with customer data demands; and the increased use of client-side software, including interactive JAVA applets, to allow more customer flexibility in data search, display, and distribution. Two major data drivers will occur over the next two years: the launch of NOAA-L in 2000 and the integration of the SAA Historical Information Processing (HIP) system in 1999-2000. HIP will populate the SAA near-term robotic tape system with NOAA POES data spanning the 1978 to 1994 era.

SAA Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
% of Satellite Active Archive operational	25/25	50	65	85	100	100

SAA Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Annual # of datasets added	5/4	4	4	4	4	4
Monthly average data granules distributed	4,300/ 1,800	4,600/ 3,000	5,000	7,000	10,000	14,000
Total # of NOAA Pathfinder products processed annually	1/3	1/4	2/5	3/6	3/7	3/8

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

SAA Milestones*	FY Goal
NOAA-K, AVHRR (1982-94), & TOVS (1978-95) data on-line	FY 99/FY 98
Robotic archive expansion to 200 terabytes	FY 99
Robotic archive expansion to 400 terabytes	FY 00
Workstation upgrades	FY 97 - FY 03
NOAA-L data on-line	FY 00/FY 99
EOS AM-1 operational data on-line	FY 01/FY 00
RADARSAT follow-on data on-line	FY 01
EOS PM-1 operational data on-line	FY 02
NOAA-M data on-line	FY 01/FY 03
METOP-1 NOAA data on-line	FY 03
NOAA-N data on-line	FY 04

* When two dates are presented divided by a "/", the first number represents the actual year the milestone was accomplished; the second number represents the original milestone year in the FY 98 Strategic Information Technology Plan.

National Environmental Data Archive and Access System (NEDAAS): The NEDASS project is replacing the NOAA Virtual Data System (NVDS) project that was previously reported on as a major system. Building on what was accomplished by the NVDS, the goal of the NEDAAS is to make all data available on-line or near on-line through the Internet within practical limits. The NEDAAS concept is a suite of information services founded on the linking of NOAA's archives with databases at NOAA's laboratories, Regional Climate Centers, State Climate Centers, and other information systems of NOAA's Line Offices. The NOAA/NESDIS Data Centers are the Nation's stewards of the largest and most comprehensive collection of environmental data and information in the world. The Climatological (National Climatic Data Center - NCDC), Oceanographic (National Oceanographic Data Center - NODC),

and Geophysical (National Geophysical Data Center - NGDC) holdings represent the chronology of the Nation's environmental history, as well as records from many other regions of the world. A large portion (over 750 terabytes) of the Nation's archive of environmental data is stored and maintained by the three data centers and the Satellite Active Archive (SAA), which are located in different areas of the country. This initiative is to provide straightforward, easy access to NOAA-managed environmental data, information, and products to a widely diverse, worldwide clientele.

The previous NVDS project is ending and being replaced by the NEDASS project, which will implement efficient management of high volumes (petabytes) of data and automate the means of data ingest, quality control, and access.

The problem facing NOAA is two-pronged: large volumes of new data and large numbers of new users who are using the World-Wide-Web (WWW) to access data. Preserving the Nation's environmental record now means managing a data volume that increases in one year by the equivalent of all the data NOAA has had to handle over the past 100 years!

The sources of the vast volumes of new data are existing and planned NASA, DoD and NOAA observing systems. Starting in FY 2001, NASA will begin to deliver Earth Observing System (EOS) data to NOAA. In preparation for this data, NOAA must increase data-handling capacity and capabilities of its Data Centers. NOAA must expand its current NASA/NOAA short-term archive project into a National Environmental Data Archive and Access System that is fully operational and managed at the enterprise level. This system will afford efficient management of high-volumes (petabytes) of data that is critical to the United States Global Change Research Program and the scientific community. The target data originates from the National Polar-orbiting Operational Environmental Satellite System (NPOESS), the Department of Defense Meteorological Satellite Program (DMSP), the Department of Commerce Next Generation Weather Radar (NEXRAD), and Polar-orbiting Operational Environmental Satellites (POES). Management of these data can be accomplished only through a rapid expansion in storage capacity at the Data Centers and automating the means of data ingest, quality control, and access. The early implementation of this archive and access system will pave the way to accommodate additional massive data volumes when new EOS satellites are deployed.

With the growth of the WWW as a ubiquitous technology, a global market has been created nearly overnight for NOAA's data and information services. The number of individuals accessing NOAA's information services has increased by two orders of magnitude in the past five years, extending far beyond NOAA's traditional user community. Electronic commerce (E-commerce) is a key objective of the DOC Secretary and the mode of doing business enabled with the global reach of Web technology. But to take advantage of the emerging marketplace, NOAA must augment its systems to deliver the services demanded.

The Data Centers are migrating to a client/server architecture, moving away from legacy site-specific IT environments. The open-systems architecture supports extensive use of Commercial Off-the-Shelf software, rapid adaptation to new technologies and procedures, reduction in

staffing, the refocus of staff talents to higher-level activities rather than routine administrative matters that can be performed by hardware and software, and optimal targeting of fiscal resources. Placing data on-line for access via the Web is the highest priority. Data storage and retrieval systems will continue to be upgraded to support effective and efficient access with special focus on Web interfaces, emerging telephony technologies, and on-line data which support the object of a NEDASS Concept of Operations.

NOAA strategic goals directly supported by the NEDAAS initiative are to "Implement Seasonal to Interannual Climate Forecasts" and to "Predict and Assess Decadal to Centennial Change". The NEDAAS structure significantly increases information and data contributions critical to projects specifically supporting the development and enhancements to "Advance Short-Term Warning and Forecast Services". It also supports all NOAA Line Offices, as well as other government agencies who have and use environmental data. The NEDASS initiative will be actively working with NOAA holders of major databases to provide them with NEDAAS archive capabilities. This initiative will expand the capability to ingest data coming to NOAA Data Centers and to house the data in a controlled and accessible system.

System Status and Plans - Much of the NVDS project funding was diverted to support the NESDIS Year 2000 conversion effort, leaving the NVDS only partially completed. This will require NVDS systems and legacy systems to operate together and will call for substantial resources in FY 2000 to maintain dual systems. There will be no additional funds in FY 2000 to fix the non-completed systems. In FY 1999, the Customer Order Management Processing System (COMPS) NVDS system will only remain 75% complete. The NVDS has several databases remotely located that contain data from all three centers. Users will be accessing all of these databases through a single thread, the NOAA National Data Center (NNDC) Server. The NVDS Wide-Area-Network will be 90% completed. With non-standard terms, a user will miss datasets and products that are available. The standardization of data elements will ensure all related datasets and products can be accessed. Data storage and retrieval systems were upgraded to support effective and efficient access in response to a variety of query sources with special focus on Internet (Web) interfaces.

The NVDS during FY 1997 - FY 1999 achieved many of its goals. Significant progress was made in installing the IT upgrades at the Centers. Many of the most popular sets were placed on-line. Enhancing existing systems such as the customer ordering and tracking process, as well as adding new features such as customer profiling capabilities, will allow NOAA to avoid costs involved with the growth of data and information. The rapidly emerging capabilities associated with telephony and utilization of E-Commerce COTS software and modules are being closely examined. In FY 1998 progress was made in developing an On-Line Store capable of handling large array data sets and the NNDC Server projects.

In FY 1999 and FY 2000, NASA will be delivering to NOAA heritage satellite datasets [Upper Atmosphere Research Satellite (UARS), Total Ozone Mapping System (TOMS), Solar Backscatter Ultraviolet (SBUV), etc.]. NOAA will provide the permanent archive and access to these datasets. The requirements were reviewed and agreed upon in October 1998 during the National Science Foundation Workshop on Global Change Science Requirements for Long Term

Archive and Data Continuity that was hosted by NASA and NOAA. Data that was managed at the NASA Goddard Space Flight Center on a short-term basis is being transferred to NOAA's permanent archive.

The most important decisions under consideration for FY 2001 - FY 2002 are centered around building a plan and architecture that will support all data storage and retrieval requirements for new satellites and NOAA's Line Offices. Using the Department of Commerce Concept of Operations (CONOPS) acquisition approach, which focuses on dramatically streamlined processes, high-performing and empowered work teams, early involvement and partnerships with vendors, and new uses of technology, NESDIS will be able to prepare for the new satellite job streams and data. With NEDAAS, a single contractor would be used for a five-year systems buy broken into several phases. There will be a planning and system architecture phase. There will be a software-build phase divided into several deliverable elements generally designed around the data associated with a satellite system that has been deployed. There will be a hardware design and data farm phase. The infrastructure improvements required to achieve these goals are: (1) a high-bandwidth telecommunications infrastructure to convey data from database computers to backbone Internet telecommunications networks; (2) highly-capable enterprise computers to service expanding user demand, including library services; and (3) storage media to ensure rapid data retrieval.

However, placing data into Internet-connected electronic systems only minimally satisfies requirements. Electronic services must be developed to allow users to discover, subset, retrieve, overlay, visualize, or analyze data of interest. This will require the adoption of industry standards and conventions to allow heterogeneous systems to communicate with one another. Secondly, it will require automated staging of communications and computational resources to execute required applications on the data. Data discovery and retrieval in an information system environment is to be done without the user having to understand the particulars of each individual system. Transaction processing must be implemented that enables an essentially "hands-off" operation requiring little or no human handling or transport of data media; where appropriate the system will allow users to pay for data or services through credit card or automated billing.

Armed with the knowledge gained from NVDS, NOAA will move into an automated customer service operation. Additionally, capital investment is needed to handle new data obtained from established datasets or from new sensors or satellites placed in orbit. With the base foundation in the NVDS, the use of extensive automation and the Internet will allow NOAA to expand its data holdings and improve its customer service without increasing its personnel costs. A new IT initiative to support the full realization of a robust user-friendly environment is essential for taking the data centers beyond the initial concept of operations and allowing for the processing of 6 petabytes of data in the next 5 to 6 years.

NEDASS-NVDS Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
% Complete - Data Centers IT upgrades (NVDS)	50/30	75/50	-	-	-	-

NEDASS-NVDS Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
% Complete - COMPS implementation @ all Centers (NVDS)	75/75 (Build 2)	75/100 (Build 2)	-	-	-	-
Number of Datasets for all Centers placed On-Line (Direct Web Access by customers) (NVDS)	33/12	34/12	-	-	-	-
NVDS Wide Area Network (% Complete) (NVDS)	50/20	90/40	-	-	-	-
% Complete - Data Centers' IT Upgrades for NEDASS	-	-	10	30	45	60
% Complete - NEDASS COMPS	-	-	0	15	50	90
Number of data Sets for all Centers placed on-line for direct access by customers	-	-	30	80	120	150
% Complete - NEDASS Wide-Area-Network	-	-	10	20	40	60

*The NVDS initiative is only funded through FY 99. The NEDASS initiative will take over from that point. When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

NEDASS/NVDS Milestones*	FY Goal
COMPS - Build 2 (NVDS)	FY 98/FY 98
UNISYS Software Migration Project (SMP) (NVDS)	FY 98/FY 99
NVDS Implemented	FY99
Complete NEDAAS Target Architecture planning	FY 01
Complete COMPS Web Integration	FY 02
Complete satellite planning for NEDAAS	FY 02
Implement Integrated Management Information Systems for NEDAAS	FY 04
NEDAAS Data Management Policy System	FY 04

NEDASS/NVDS Milestones*	FY Goal
Complete IT upgrade for new access to environmental data holdings	FY 05
Complete On-line Store upgrade for new satellite data	FY 05
Complete unified archive management	FY 06
Complete software conversion to open systems	FY 07
Complete Target Architecture opportunities implementation	FY 08
Complete NNDC Server satellite delivery system upgrades	FY 08

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Research Systems: OAR supports observing systems necessary for the development of forecasts products and climate models. The Geophysical Fluid Dynamics Laboratory focuses on improving coupled ocean-atmosphere models and assimilation methods, exploring the levels of predictability of model-based forecasts, and providing these models and results to prediction centers. The Climatic Diagnostics Center analyzes the accuracy and utility of observations, models, and assimilation techniques for prediction systems. The Hayes Center (a joint center of the Pacific Marine Environmental Laboratory (PMEL) and the University of Washington) is developing predictive global coupled models of the El Niño-Southern Oscillation (ENSO) phenomena. PMEL is the major contributor to the ENSO Observing System. PMEL implemented, maintains, and is responsible for all aspects of data delivery from the TAO (Tropical Atmosphere-Ocean) array in the equatorial Pacific, the Pacific profiler and upper-air networks, and the global drifter program.

Within NOAA research is conducted by many separate organizations in many different locations. These research organizations use a common computing architecture consisting of PCs and scientific workstations interconnected with high-speed networks to data and computing servers. The Internet is used to collaborate with colleagues at other research organizations.

Other Systems: The NCEP supercomputer system reported on in the "Advance Short-Term Warning and Forecast Services" section of this plan is also used to accomplish NOAA's "Implement Seasonal to Interannual Climate Forecasts" goal. The Coupled Ocean-Atmosphere ENSO Forecast Model performance measure reported for the NCEP system is a measure of the NCEP system's contribution to meeting climate forecast goals.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or

enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 99	FY 00	FY 01	FY 02	FY 03
SAA	Development/ enhancement	700	250	400	500	500
	Steady state	1,200	1,250	1,400	1,500	1,600
NEDASS/ NVDS*	Development/ enhancement	6,500**	0	9,700	10,800	11,800
	Steady state	0	2,500	1,500	2,000	2,000

*NVDS is not funded for FY 99 and FY 00. In FY 01 the NNDC project will begin using the basic NVDS design.
**Part of the FY 99 funds were redirected to support NESDIS Y2K activities.

Future Investments: In order to continue to respond rapidly and effectively to such events as El Nino and to provide timely responses to unprecedented demands for climate information and forecasts from the public, media, and decision-makers, consideration is being given to the following as possible IT budget initiatives for the FY 2001 budget:

NCEP: NOAA is considering the possibility of augmenting the power of the planned Class IX computer to enable NWS to implement the operational integrated suite of climate forecasts.

NOAA Data Centers: Massive volumes of NOAA archival data are on aging technology and need to have their accessibility increased. A plan has been devised to transfer the data (i.e., GOES satellite archive on U-matic tapes, WSR88-D data stored on 8mm tapes, etc.) to a robotic tape system or other suitable tape management system. In addition, NOAA must begin to develop the archive and access system to handle new massive data systems that will be coming from the National Polar-Orbiting Environmental Satellite System Preparatory Project. This includes the ability to reprocess the data and migrate the data to new technology based on industry standards.

STRATEGIC GOAL: PREDICT AND ASSESS DECADAL TO CENTENNIAL CHANGE

The Programmatic Goal and Objectives: NOAA will provide science-based options to support international policy and management decisions affecting the future of our global environment. A long-term climate record and a new generation of climate models are needed to predict and assess the climate impact of greenhouse gases trends and forcing agents, ozone-layer depletion and rehabilitation, and air-quality detection and improvement. Specific objectives will be to: characterize the forcing agents of climate change; understand the role of oceans in global change; guide the rehabilitation of the ozone layer; provide the scientific basis for improved air quality; and furnish prediction, assessment, and human-impact information. The primary Line or Program Offices involved in this goal are OAR, NESDIS, and the Office of Global Programs.

GFDL High-Performance Computing: Geophysical Fluid Dynamics Laboratory (GFDL) scientists are working at the forefront of the climate and weather research community in the development and use of sophisticated numerical models to predict and understand atmospheric and oceanic phenomena. These research activities, which are critical to the Nation and to NOAA's ability to predict weather and climate behavior, rely on state-of-the-art computing capabilities. GFDL has nearly 40 years of experience in acquiring, managing, and utilizing large-scale computing systems which are central to the success of the Laboratory's research mission.

The FY 2000 budget initiative for a $5.7 million increase to fund the acquisition of a large, scalable computer system and IT support capabilities will be used to leverage the world-class research staff and modeling capabilities now in place at GFDL for climate and weather research.

GFDL's high-performance computing plans address the laboratory's growing scientific computing needs through a strategy of continued incremental growth in computational and archival storage capacity. As GFDL's recent benefit/cost analyses of FY 1993 and FY 1998 indicate, increased system capacity produces important additional societal benefits that result from enhanced GFDL research capabilities, which include more sophisticated models and model physics, more comprehensive modeling experiments, and higher-resolution simulations. Recent GFDL accomplishments have translated into important breakthroughs in hurricane prediction, understanding of climate change, and simulation of the complex ocean-atmosphere system.

Recent concern about climate change and the 1997-98 El Niño event have spurred interest around the world, including the United States, in the development of national programs to improve climate prediction capabilities. However, the success of these efforts will depend heavily on physics-based climate modeling and fundamental climate science, two areas in which NOAA/GFDL scientists are among the world's leaders. A sharp increase in computing and archival capabilities is the remaining ingredient required to allow the Laboratory to attack the very difficult problems confronting the climate research community and to support on-going and

developing research collaborations within NOAA as well as with other government agencies, academic institutions, and research centers around the world. Efforts to address this critical need are the focus of an FY 2000 computing initiative that will be discussed in the "System Status" Section that follows.

While mission-critical results from GFDL high-performance computing are realized in the laboratory's research accomplishments, the performance measures provided are a mechanism for tracking the lab's computing and model-development activities that are critical to the continued progress of the GFDL's research mission. The milestones indicate important procurement events and major research goals that provide some indicators of the success of the proposed computational initiative.

System Status and Plans - The Laboratory's production system consists of a 26-processor Silicon Graphics Inc. (SGI) Cray T932 parallel-vector processor system with an associated very-high-capacity solid state disk. The archival storage system consists of 2 StorageTek silos with a capacity of up to 240 trillion bytes (terabytes) with data management provided by SGI's Data Migration Facility that, until recently, has been run on the T932 production system.

As indicated in previous reports, the reliability of the T932 system degraded significantly following the February 1997 upgrade, a pattern that appears to be common to most large-chassis T90 systems. In response to the poor system reliability and to the adverse effect of inefficient I/O jobs on the overall T932 efficiency, an engineering change was negotiated with SGI to modify the final contract upgrade that was scheduled to be completed by October 1998. Rather than installing 4-6 additional processors in the T932 as prescribed in the original contract, a separate, four-processor T94 system was installed in August 1998. This upgrade not only provided the required computational upgrade, but also provided a separate, more reliable computing platform with its own memory, large rotating disk storage, and solid-state disk system.

The T94 functions as the primary data server for the archive storage system. The new system, which has generally been much more reliable than the T932, has provided increased stability to the GFDL computing environment by offering more reliable access to the data archive and serving as an effective interactive and analysis platform that has reduced the I/O workload on the T932. The total T90 CP hours available increased from an average of 16,600 per month prior to the T94 installation to an average of 18,300 per month through February 1999. Under a lease-to-purchase arrangement to be completed during the first month of FY 2001, the Government will own this moderate-sized T90 system for continued use following the departure of the T932 at the end of October 2000. The T94 will continue to act as a data server for the current archive and will also provide a legacy T90 platform to assist GFDL staff with any remaining code conversion activities during 2001 and possibly beyond.

The Laboratory's third high-performance computer system is a scalable 40-processor SGI T3E-900 system with 128 MB of local memory per processor, a separate rotating-disk file system of its own, and high-speed channels that directly connect it to the T932 and T94. The T3E is an important development platform for redesigning GFDL models to a scalable-architecture

paradigm. The system has demonstrated outstanding reliability and has provided significant production capability for several experiments.

Analysis and visualization are critical components of GFDL's computational research process, since it is through these mechanisms that researchers gain understanding of their model results. This requires effective access by scientists to model data, which in turn requires substantial bandwidth to desktop workstations. As an important step to providing this access, GFDL replaced its current network with a new high-speed local-area network in October 1998. The new network consists of a 2000-Mbps full-duplex Gigabit Ethernet backbone and switched 10/100 Mbps Fast Ethernet to each workstation. This network provides a substantial bandwidth increase to the desktop, while permitting the Laboratory to continue to support standard Ethernet connections to current workstations without the immediate need for a wholesale replacement of desktop systems.

GFDL's desktop environment consists of 115 desktop workstations and servers ranging from SGI Indigo's and Indigo2's to SGI 4D/25's. Even the newest of these platforms is significantly less powerful than the latest Intel-based personal computers (PCs). Given the increasing cost-effectiveness of commodity PCs, the Laboratory will investigate the possibility of making a transition to a desktop environment that is based on such PCs running Linux, rather than more expensive RISC-based systems . To this end, GFDL will purchase several PCs to serve as test systems for evaluation of this strategy. Development of transition strategies for GFDL's desktop workstations as well as high-end visualization will be key elements in the plans for the future analysis and visualization infrastructure that will be critical to the lab's new computational initiative. In addition, GFDL plans to upgrade its access to the Internet based on the needs of its outside users and the requirements of its users to access large data sets at other sites in order to carry out their research.

A first version of the GFDL IT Architecture Plan, including a Technical Reference Model and a Standards Profile, was released in June 1998. This plan describes GFDL's mission and products and outlined the current and target architectures in terms of work, information flow, applications, and technology views. A gap analysis was conducted which identified several key changes, opportunities, and upgrades anticipated in the transition to the target architecture. The plan will be used and upgraded as part of the upcoming procurement planning process. It will also be valuable as input for the NOAA High Performance Computing Study that was initiated during the past winter.

As discussed in the previous section, NOAA has recognized a substantial increase in demand for research products in both climate and weather areas that are central to GFDL's research activities. Because of this accelerated demand, DOC, OMB, and the Office of Science and Technology Policy are supporting a FY 2000 budget initiative for a $5.7 million increase to fund the acquisition of a very large, scalable computer system and necessary IT support capabilities for GFDL that will be needed to provide critical computing, storage, analysis, and software capabilities. This computing initiative, which is part of the interagency "IT Initiative for the Twenty-First Century," referred to as "IT^2," is very important if NOAA is to leverage the world-class research staff and modeling capabilities now in place at GFDL to address important research

problems in climate and weather research. The Laboratory's on-going model development effort, supported by HPCC, is positioning GFDL to take full advantage of the scalable architectures being developed by the American computer industry.

Last spring, GFDL completed a full initiative package for its budget submission, including the IT architecture plan described above and a benefit/cost analysis, which included a retrospective analysis of past benefits achieved by GFDL research. Subsequently, this initiative became the NOAA submission to the six-agency IT^2 Initiative. The proposal addresses both the acquisition of a balanced high-performance computing system to attack extremely compute-intensive problems and also the development of complementary software capabilities that are equally important to the success of this program.

The transition to new scalable, cache-based architecture systems from current parallel-vector systems will involve a substantial challenge to GFDL, as it has for other organizations facing similar transitions. GFDL has been working to prepare for this for the past several years with assistance of the NOAA/HPCC Program. GFDL scientists are now accelerating their efforts to convert major GFDL models to versions that will be able to execute on scalable, distributed-memory systems.

During FY 1999 GFDL will complete initial development of scalable versions of at least three important models and the refinement of two major models to production status on the T932 system. Conversion of the GFDL Hurricane Prediction System is currently underway with support from the NOAA/HPCC Program; this model is expected to be ready to execute on the National Weather Service's IBM SP system by the summer and will be available for use during the fall 1999 hurricane season. A production-capable, scalable version of the GFDL Modular Ocean Model (MOM), including parallel I/O, is expected to be ready this spring. Demand for MOM continues to be high from the members of its user community, both inside and outside of NOAA. In addition, GFDL scientists will require this model for use in a high-resolution, southern ocean experiment, known as MESO, that will be run on GFDL's current and future systems as well as remotely in collaboration with Department of Energy scientists at Lawrence Berkeley National Lab (LBNL). Currently Laboratory scientists are running an experiment on LBNL's T3E as well as the T932 using the GFDL Ocean Group's Hybrid Isopycnal Model, which was converted to a scalable, production-capable form during the past year.

Current development activities include work on tools that offer a flexible way to implement message-passing calls and provide a parallel I/O mechanism which is independent of computing platform. These tools are now being tested on the T3E. Also GFDL scientists are engaged in a major effort to develop a coordinated atmospheric model to replace the Laboratory's major models with a single model system involving several dynamical cores and component-based, modular physics packages. Scalable design of the spectral core for this model has recently been completed, while revision of the grid-point core is currently underway.

In parallel with the model development effort, GFDL has formed a number of technical working groups to investigate important issues associated with the upcoming procurement. These working groups, that are made up of members of the Laboratory's user community, are

addressing a number of important areas including production computing, storage, and analysis. GFDL has also identified a contracting office within NOAA to carry out the planned procurement and currently is assembling a CONOPS team. The 1999 schedule calls for completion of the Project Agreement during the spring, an extensive request-for-information period during the summer, and formal issuing of the Request-for-Proposals in the fall after funds are appropriated. Contract award is targeted for Spring 2000 and initial installation for the summer.

In parallel with the hardware acquisition, NOAA/GFDL is also requesting funding for related software and other IT development activities. This will involve vital research and development activities on software issues that are critical to the success of the planned computational initiative, including component-based modular code design, code optimization, and algorithm development. This research will include university partnering, such as the collaboration being developed for joint graduate student appointments between the NOAA-supported Atmospheric and Oceanic Science Program and the Princeton University Computer Science Department.

GFDL is centrally involved in the NOAA High Performance Computing Study that started this past winter. This study, sponsored by the NOAA HPCC Program, will develop an IT architecture plan for NOAA's high performance computing and will identify ways that NOAA can better coordinate activities that provide computing resources that are critical to many of its mission-critical activities.

GFDL Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Total user CP hours per month (in units of 1000 T90-CPU hours) on production system	16/15	18/17	18	80	130/ 120	180/ 140
Total usage of archive storage (in terabytes)	51/45	73/70	100	175/ 140	300/ 200	440/ 280
Total available archive storage (in terabytes)	60/60	120/90	120	200/ 160	350/ 230	500/ 320
Annual # of additional production-capable parallel applications implemented on the production system (currently T90)	1/1	2/1	2	2	2	2
Annual # of additional major or support applications converted to the scalable development (T3E) system	2/2	3/2	2	–	–	–

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

GFDL Milestones*	FY Goal
Upgrade parallel vector system to 16 times YMP benchmark performance	An additional system was installed as part of the upgrade/FY 98
Evaluate progress of the conversion of GFDL's major model codes to run on new scalable architecture systems.	Q2 FY 99/ Q2 FY 99
Perform market survey of industry, including release for vendor comment of early versions of possible benchmark codes.	Q4 FY 99
Evaluate progress of the conversion of GFDL's major model codes to run on new scalable architecture systems.	FY 00
Award contract for scalable high performance computer system.	FY 00/01
Complete site preparation and install initial systems.	FY 00
Final lease payment under current supercomputer contract.	FY 00
Evaluate the capabilities of a more advanced GFDL Hurricane Prediction System for providing improved track forecasts as well as predicting other storm features, such as wind and precipitation fields and changes in storm intensity.	FY 01
Demonstrate progress in improving the capabilities of the next-generation GFDL coupled research model for predicting seasonal-interannual climate and for elucidating some of the processes that control El-Niño-Southern-Oscillation events.	FY 02
Scheduled mid-life system upgrade to enhance performance of the scalable high-performance computer system	FY 02
Isolate sources of climate "drift" and define a strategy for reducing their effect on long-running, higher resolution coupled climate models.	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Research Systems: OAR monitors trends in the atmospheric distribution of radiatively important trace species and studies their interactions with each other, land, and oceans. OAR conducts major programs to collect and analyze oceanographic data to evaluate models of ocean circulation and predictive models of climate variability. As the result of a U.S. project starting in 1981, available global surface marine data for (currently) 1854-1993 have been assembled, quality controlled, and made widely available to the international research community in easily used products of the Comprehensive Ocean-Atmosphere Data Set (COADS). The project is a

continuing cooperative enterprise between NOAA - OAR's Climate Diagnostics Center, the NESDIS National Climatic Data Center/Global Climate Laboratory, and the Cooperative Institute for Research in Environmental Sciences (conducted jointly with the University of Colorado)--and the National Science Foundation's National Center for Atmospheric Research. OAR is the leading organization in the United States with a comprehensive program to understand the earth's stratospheric ozone layer, developing and deploying new instrumentation essential for enhanced observations, analysis, and understanding of photochemical processes on ozone. The Aeronomy Laboratory has made major scientific contributions in discovering the cause of the Antarctic ozone hole, understanding the processes that determine the quality of the air we breathe, studying how the atmosphere's chemistry and physics might influence the climate of the Earth, and extending wind and precipitation measurements in the tropical Pacific, to better understand and better predict El Niño. The Climate Monitoring and Diagnostics Laboratory (CMDL) provides data that are used to assess climate forcing and ozone depletion, to develop and test predictive models, and to keep scientists, policy makers, and the public abreast of the current state of our chemical and radiative atmosphere. CMDL provides data and interpretations which are used extensively in the World Meteorological Organization/United Nations Environment Programme Scientific Assessments of Ozone Depletion and the Intergovernmental Panel on Climate Change Reports. OAR also supports the observational and research program to study key atmospheric reactions and perturbations that may impact air quality both in the United States and globally. Field programs and lab studies are combined with modeling and prediction studies to assist in the development of emission control strategies.

Within NOAA research is conducted by many separate organizations in many different locations. These research organizations use a common computing architecture consisting of PCs and scientific workstations interconnected with high-speed networks to data and computing servers. The Internet is used to collaborate with colleagues at other research organizations.

Other Systems: Some IT systems that primarily support other NOAA strategic goals will also support the objectives of this goal. The datasets of the SAA and the NOAA National Environmental Data Archive and Access System project, both described in more detail in the "Implement Season to Interannual Climate Forecasts" section, will support research in this area.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 99	FY 00	FY 01	FY 02	FY 03
GFDL	Development/ enhancement	877	6,499	15,836	15,494	15,505
	Steady state	8,704	8,845	1,631	1,925	1,964

Future Investments: Advancements in climate modeling are dependent upon increases in the computational power available to NOAA researchers. While operating its current high-performance computing systems, the GFDL is always engaged in planning for the future. Investments will be required to facilitate transitions to higher-performing systems and to new high-performance computing architectures. Never before has there been such a high demand from GFDL's customers for results from the laboratory's modeling research, due to recently increased interest in climate change issues. However, in the face of this dramatically increasing demand for GFDL research, the laboratory foresees considerable difficulty in keeping pace with the computing capabilities available at modeling research centers abroad without increased funding for GFDL's next supercomputer procurement. This is because foreign modeling centers have access to lower-cost foreign vector supercomputers that are not easily accessible to U.S. centers.

STRATEGIC GOAL: PROMOTE SAFE NAVIGATION

The Programmatic Goal and Objectives: In order to achieve the benefits envisioned under the Promote Safe Navigation strategic goal, NOAA will need to continue investing in information technology. Desired benefits include reduced marine navigation risks, enhanced environmental protections, and heightened competitiveness of the U.S. shipping industry. Investments in information technology are encompassing all of the objectives of Promote Safe Navigation including: to build, maintain and deliver a digital nautical charting database to underpin new electronic navigation systems and which integrate satellite positioning, tidal heights and currents, radar and sonar, and navigational aides; to update nautical surveys of the Nation's coastal areas using full-bottom coverage technologies; to define the national shoreline in an accurate and consistent manner using state-of-the-art technology to serve the Nation's navigational and coastal managers; to provide mariners with real-time observations and forecasts of water levels, tides and currents, and weather conditions in ports; and to transform the obsolete geodetic reference frame into a GPS-based system of monumented marks and continuously-operating reference stations to support the digital revolution in mapping, charting, and surveying. The primary Line Office involved in achieving this goal is NOS.

Nautical Charting and Surveying System: To support NOAA's strategic goal to "Promote Safe Navigation" NOS must (1) update nautical surveys of the coastal areas using full-bottom coverage technologies and (2) maintain and deliver the navigational charts to support commercial and recreational use of the Nation's waterways.

The Nautical Charting and Surveying Program is moving towards Print-On-Demand technology for meeting chart requests. Users will be able to quickly obtain up-to-date charts. The program also is continuing efforts to complete a vector electronic navigational chart database.

The Nautical Charting and Surveying System meets the demand for more current nautical information, greater protection of life, property, and the environment, as well as significantly improve the efficiency of maritime commerce. System objectives are to upgrade acquisition technology; optimize hydrographic data transfer on computer systems; build, maintain and deliver a digital nautical database to underpin new electronic navigational systems; and to improve the productivity of the chart-making process for safe and efficient marine navigation.

NOS is creating a Vector Electronic Nautical Chart (ENC) in the internationally-accepted S-57 format to produce the vector electronic chart data. The vector chart can be used in conjunction with raster data in electronic navigational systems. Clearly these actions depend upon the use of information technology and the achievement of these goals will be delayed by budget limitations.

The information technology architecture being used to support NOAA's nautical charting and surveying program is desk-top computer systems and commercial off-the-shelf software, with relatively low-risk internal software development.

System Status and Plans - The Electronic Nautical Charts database is completely built and currently provides 33% of the Electronic Nautical Charts expected. The Raster Chart Database is completely built and currently provides on a weekly basis updates of 100% of the Raster Charts, including information from the Notice to Mariners. The Notice to Mariners is a periodical or casual notice issued by Hydrographic Offices or competent authorities regarding changes in aids to navigation, dangers to navigation, important new soundings, and in general, all such information as affects nautical charts, sailing directions, light lists and other nautical publications.

The Nautical Charting and Surveying System provides 25% of its paper charts via Print-on-Demand technology, and these charts also include the latest information from the Notice to Mariners. Print-on-Demand (POD) is the use of large format inkjet or electrostatic plotters to produce NOAA nautical charts. POD technology is one way to provide mariners with more up-to-date charts. To use Print-On-Demand, NOS updates digital files of all charts each week for all Notice to Mariner items. Charts would then be printed when ordered using these updated files. The Print-On-Demand charts are expected to level off at 50% of requests because they are produced on demand and NOS does not expect more than 50% of the charts to be requested at one time.

A S-57 compliant seamless vector database for the main components of the inland river navigation systems is expected for development and delivery in cooperation with the U.S. Coast Guard and the U.S. Army Corps of Engineers.

The system has completed 15% of the backlog of critical area surveys. The reconfiguration of NOAA's ship RUDE's multi-beam data acquisition processing system is complete. The reconfiguration of RUDE's shipboard hydrographic data acquisition and processing systems is complete (ahead of schedule) also.

Year 2000 issues were addressed and completed in 1998 and 1999.

The Nautical Charting and Surveying System performance measures were modified. The chart suite was divided into two categories, Print-On-Demand Charts and Raster Charts, the categories were separated to better reflect the goals. The databases for both the ENC Charts and the Raster Charts are complete. However, the maintenance and availability for these databases are an on-going performance measure for the future.

In FY 2000 and beyond NOS will continue to improve and refine nautical charting production processes and services. The focus will be on the following areas: (1) to fully implement continuous maintenance of the digital raster nautical charting database keeping all 1000 nautical charts in a constant state of currency; (2) to continue the delivery of a raster electronic chart product through a partnership with the private sector; (3) to make the transition from lithographic offset printing to "print-on-demand"; (4) to complete the collection of a vector electronic

navigational chart (ENC) database in the Internationally accepted S-57 format for the Nation's priority ports and harbors, and to incrementally expand this vector chart coverage as appropriate and as required by the user; and (5) to complete a major redesign and recompilation of the entire set of Coast Pilot Volumes. Other possible efforts would involve the production of inland waterways charts and customized charting products.

Nautical Charting and Surveying System Performance Measures	FY98	FY 99	FY 00	FY 01	FY 02	FY 03
% of digital database built for Electronic Nautical Charts (ENC)	100/80	100	100	100	100	100
% of digital DB maintained & available for Electronic Nautical Charts (ENC)	15	33	100	100	100	100
% of digital database built for raster charts	100/ 100	100	100	100	100	100
% of Print on Demand charts updated	12	25	50	50	50	50
% of Raster Charts updated for on a weekly basis (CD format)	100	100	100	100	100	100
% of backlog of critical area surveys completed (cumulative)	15/16	18/19	23/22	26/25	30/28	33/31

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

Nautical Charting and Surveying System Milestones	FY Goal
Complete the reconfiguration of NOAA ship RUDE's multi-beam data acquisition processing system	FY 98/FY98
Accomplishing 100% Raster Charts updated for Notice to Mariners	FY 98/FY98
Complete the reconfiguration of shipboard hydrographic data acquisition and processing systems	FY99(accomplished)/ FY99
Complete the development of hydrographic smooth sheet production and SCARS workstation processing	FY 99
Accomplishing 50% of Print-On-Demand Charts updated for Notice to Mariners	FY 00

Nautical Charting and Surveying System Milestones	FY Goal
100% of ENC S-57 database completed, maintained, and available	FY 00

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Real-Time Observations and Forecasts of Water Levels, Tides, and Currents:

A Physical Oceanographic Real-Time System (PORTS) provides real-time environmental observations and forecasts for a specific U.S. port as needed by the marine transportation community and other users requiring operational oceanographic information. Each PORTS is designed to meet local user requirements.

A PORTS provides real-time oceanographic data for port operators and mariners. The focus now is to ensure that the data is quality-controlled and can be used for decision-support.

PORTS plays an important role in NOAA's strategic goals to promote safe navigation and sustain healthy coasts. It is a decision support tool that provides real-time environmental information for a given U.S. port needed to establish navigation parameters for safe travel within the port; to determine appropriate cargo transport load information; and to define both present and future oceanographic conditions at the given location.

The benefits derived from PORTS include a reduction in maritime transportation risks; mitigation of damages should an accident occur; increased cargoes able to move safely and efficiently into and out of the Nation's ports and harbors; and support to coastal planners and researchers in order that safe and efficient development of our coastal and ocean resources can be achieved.

PORTS systems come in a variety of sizes and configurations. The largest existing installations comprise over 26 separate instruments. The smallest consist of a single water-level gauge and associated meteorological instruments, and are referred to as "PORTS Lite". Each PORTS system acquires oceanographic instrument data and disseminates observations through digital and voice modes. Each system has a PC for data acquisition, a PC for a voice host, and a PC to serve as a gateway to the Internet. If needed, another component of a PORTS is a model-based nowcast/forecast system. A nowcast/forecast system requires a mini-supercomputer platform for the computations and a scientific workstation for data display and dissemination. Each PORTS is monitored through the Continuous Operational Real-Time Monitoring System (CORMS). The CORMS provides 7 day a week, 24 hour a day monitoring and quality control of instruments and data in order to ensure the availability, accuracy, and quality of the real-time environmental observations. The CORMS combines the use of real-time communications, data analysis, system monitoring, and electronic reporting and notifications techniques to perform its tasks.

System Status And Plans - A full PORTS is operational in Tampa Bay, Florida; New York City, New York; San Francisco Bay, California; Houston/Galveston, Texas; and Chesapeake, Virginia. A PORTS Lite is installed in Anchorage, Alaska; Nikiski, Alaska; Seattle, Washington;

Tacoma, Washington; Baltimore, Maryland; and Hampton Roads, Virginia. During the coming year, a full PORTS will be established in Narragansett Bay, Rhode Island and a PORTS Lite will be established in Soo Locks, Michigan.

During the past year, all components of PORTS, both hardware and software, at all sites, were made to be Y2K-compliant.

During the past year, the platform, TESTPORT, which collects all data from the various PORTS sites and distributes all data to the various PORTS processes, became operational. A standardized format, PORTS Uniform Flat File Format (PUFFF), was established for distributing PORTS data in site-independent, flat, ASCII files. A data model was completed for a National PORTS Database (NPDB) into which all data acquired through a PORTS will be placed. In addition, a NPDB implementation plan was completed for both the implementation of the database and the user interface to the database.

During the coming year, the NPDB will be established. A mechanism for populating the database on a continuous basis will be implemented. An interface for populating the NPDB with metadata and a Web-based interface for retrieving data from the NPDB will be completed.

During the coming year, a regional nowcast/forecast system for the Chesapeake Bay will become operational. Currently, a experimental system known as the Chesapeake Area Forecasting Experiment (CAFÉ) is being run and evaluated. CAFÉ will be renamed the Chesapeake Bay Operational Forecast System once it goes into operation.

Over the next several years, a knowledge-based version of CORMS will be implemented. The original completion date was FY 2000; however, progress has been hampered due to lack of resources and the implementation date is being delayed until FY 2001. In the coming year, the Rensselaer Polytechnic Institute will complete a requirements analysis for this next generation CORMS. The analysis will address implementing a knowledge-based system that employs the use of embedded intelligence and levels of user decision-aiding.

PORTS Performance Measures*	**FY 98**	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**
Total PORTS & PORTS Lites implemented	11/8	13/10	15/12	15/14	17/16	19/18
% of PORTS data quality controlled	100/100	100	100	100	100	100

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

PORTS Milestones*	FY Goal
Implement Chesapeake Bay regional forecast system	FY 99/FY 98
Install Narragansett Bay and Soo Locks PORTS	FY 99
Install Delaware Bay and Los Angeles/Long Beach PORTS	FY 00
Implement National PORTS Database	FY 00
Implement knowledge-based CORMS	FY 01/FY 00
Install Charleston and San Diego PORTS	FY 02
Implement PORTS Analysis Database	FY 02
Install Boston and Nikiski PORTS	FY 03

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The Data Processing and Analysis Subsystem (DPAS) for NWLON: The National Water Level Observation Network (NWLON) provides the foundation for the tidal and Great Lakes vertical water-datum control for the nation. A key IT support system for NWLON is the Data Processing and Analysis Subsystem (DPAS) which processes data acquired from NWLON sites, performs quality-control functions, and makes the data available to users.

DPAS processes and quality-controls tide and water-level data, and makes it available to users. The system is now operational.

The NWLON DPAS plays an important role in NOAA's strategic goals to promote safe navigation and sustain healthy coasts. It provides tide and water-level information needed to establish and maintain the vertical water level reference required to support nautical chart production; to determine state and federal boundaries; and to define setbacks from high water lines.

The benefits derived from this system include a reduction in maritime transportation risks which thereby heightens the competitiveness of the U.S. shipping industry and support to coastal zone planners and researchers in order that safe and efficient development of our coastal and ocean resources can be achieved.

NWLON uses a client-server architecture that relies upon RISC-based workstations as the servers and PCs as the clients. It consists of a Data Acquisition Platform which is a PC that places a call to NOAA's Command and Data Acquisition ground station at Wallops Island, Virginia, every hour to download data through a captured Telnet session. The PC then decodes the data and checks the quality. The initial data checks provide preliminary quality assurance. The data is then loaded into a database from which data processing is done before making the data available to

users. Much of the DPAS software was developed for its specialized functions of quality control, quality assurance, and for its specific applications.

System Status and Plans - The NWLON DPAS system is fully operational. During the past year, all components of DPAS, both hardware and software, were made to be Year 2000-compliant and the first phase of the DPAS client migration was successfully completed. Each DPAS client workstation was moved from an OS/2-based system to a Windows NT-based system in order to provide a more robust and maintainable environment in which to process data.

During the coming year, the final phase of the DPAS client migration will be completed. The DPAS client server which provides client software services, files services, and print services will be moved from an OpenVMS-based system to a Windows NT-based system. This will complete the DPAS client migration to a single operating environment.

Several other infrastructure changes are also planned. First, the current DPAS data collection platform will be migrated from a OS/2-based system to a Unix-based system. At the same time, the primary source from which data will be collected will be changed to the National Weather Service's Gateway. This will replace phone calls to Wallops Island, Virginia. Eventually, improved software will be implemented to modernize the methodology being used to perform preliminary quality control on incoming data. Second, the DPAS database server will be upgraded to a system which can offer improved performance over the system currently being used.

DPAS Performance Measure*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
% increase in processing rate of monthly water level station data through DPAS	25/25	35	35/25	35	45	45

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DPAS Milestones	FY Goal
Complete modernization of 80% of NWLON sites	FY 98/FY 98
Complete modernization of all NWLON sites	FY 99
Complete modernization of DPAS Data Collection Platform	FY 00
Complete VMS to Windows NT server migration	FY 00/FY 01
Complete modernization of DPAS Database Server Platform	FY 00
Implement additional automated data processing capabilities	FY 01
Implement data entry capability via remote sites	FY 02

DPAS Milestones	FY Goal
Implement Web-based DPAS client interface	FY 03

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Geodetic Support System: The Geodetic Support System performs functions necessary for NOAA to attain its objective to "Develop the National Spatial Reference System (NSRS)", which is part of NOAA's strategic goal to "Promote Safe Navigation". The NSRS provides a common geographic framework and is the foundation for the National Spatial Data Infrastructure (NSDI), which is a critical component of the "information superhighway" and is essential for mapping, charting, navigation, boundary determination, property delineation, resource evaluation surveys, and scientific applications. NSDI facilitates data sharing by organizing and providing a structure of relationships between producers and users of spatial data and thus ensures consistent and reliable means to share spatial data. The System acquires data from Global Positioning System (GPS) Continuously Operating Reference Stations (CORS) and other sources, runs GPS and geoid reduction software, and performs other functions that require high computational speeds. The GPS satellite tracking data is processed to determine satellite orbits and to establish, maintain, and monitor a national GPS network. The National Geodetic Survey (NGS) collects and distributes GPS observational data from a nationwide network of permanently operating GPS receivers. The Federal Base Network (FBN), the foundation of the NSRS, comprises both horizontal and vertical positions of monumented stations. The NSRS is complemented by a geoid model, enabling users to determine elevations accurately and efficiently. All data is managed by the NGS Integrated Data Base (NGSIDB) System, which is the source of all products supplied to the user community.

The Geodetic Support System processes data for the National Spatial Reference System and geoid models. It is moving towards a more standardized architecture and requires additional computing power.

The primary objective of CORS is to provide local users with ties to NSRS for post-processing position determination. NSRS provides a consistent national coordinate system that defines latitude, longitude, height, scale, gravity, and orientation throughout the United States, and how these values change with time. As the basis for mapping, charting, navigation, boundary determination, property delineation, infrastructure development, resource evaluation surveys, and scientific applications, NSRS plays a critical role in ensuring the Nation's public safety, economic prosperity, and environmental well being. The system provides geodetic data to a variety of users, including surveyors, universities, state highway departments and large engineering firms. Observational data is made available to the user community within 24 hours. CORS consists observation stations and a central data facility, make available over the Internet. The observational data comes from a network of about 150 GPS receivers.

The Geodetic Support System is based on an architecture of scientific workstations used as servers and PCs used for analysis and other functions. The system provides its products to the general public through FTP services, the Internet, and by CD-ROM.

System Status and Plans - The system is operational, with over 150 CORS sites and 1454 FBN stations. In FY 1999 NGS deployed 40 new CORS sites, bringing the total number of sites to 160, and decided to increase the number of CORS sites to be deployed. Additional sites increase system density and therefore provide greater data accuracy and system reliability. Data accuracy diminishes as one moves more than 100 km from a CORS, and currently only 33% of the U.S. is within this range, with 15% of the nation over 300 km from a site. Increasing CORS to 1000 stations will place at least 2 CORS within 100 km of any point in the U.S. This decision will result in the deployment of 100 new CORS sites in each of the next 8 fiscal years.

Also in FY 1999 NGS purchased hardware and software to provide a centralized backup of all data. It also replaced older RISC workstations, which will not run the current Operating System (OS). The new OS is needed to run the current versions of the COTS production software used by NGS. The first NGS Windows NT Server was deployed. NGS replaced all 386/486 PCs with new Pentium PC/Workstation terminals running the Microsoft NT 4.0 OS and using a TCP/IP network. A RAID system was purchased to provide 1 year of CORS data on-line (150GB). All new systems are Y2K-compliant and all remaining systems are scheduled for upgrades during FY 1999.

In FY 2000, the FBN vertical data will begin being supplemented with data from CORS. This Height Modernization Program is funded in the Presidential FY 2000 budget. The telecommunication backbone will be upgraded to100mbs. Additional efforts maybe directed towards the development and distribution of additional geospatial data for use with GIS systems and the improvement of global positioning system (GPS) measurements to support three-dimensional positioning within an hour of observing the GPS data. The first would aid persons involved in environmental management, planning, research, and navigation, while the improved GPS measurements would aid in positioning activities, the monitoring of crustal deformation, and in ionospheric measurements. Finally, consideration is being given to modernizing the national height system by integrating horizontal, vertical, and gravity control networks into a unified positioning system, which would support determinations of erosion rates and flood plain boundaries, under-keep clearances for large marine vessels, and storm surge and pollution trajectories. It would also assist in disaster preparedness and produce savings in the cost of field surveying.

Geodetic Support Performance Measures	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
CORS stations operational (goal 1000)	138/65	171/60	200/83	300/88	400/93	500/97
Accuracy of gravimetric geoid model (cm)	9.0/9.0	8.0	7.5	7.0	6.5	6.0

Geodetic Support Performance Measures	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
% of FBN completed (horizontal)	100/ 100	100	100	100	100	100
% of FBN complete (vertical)	40/43	59/62	70/80	81/100	92/100	100

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Geodetic Support System Milestones	FY Goal
FBN Total Horizontal Stations 1454	FY 98/FY 98
Expand CORS to 150 stations	FY 99
Complete and publish new geoid model	FY 99
Expand CORS to 200 stations	FY 00
Perform network adjustment of entire NSRS and populate NGSIDB	FY 00
Expand CORS to 300 stations	FY 01
GEOID '02 (New Geoid Model)	FY 02
Expand CORS to 400 stations	FY 02
FBN Total Vertical Stations 911	FY 03
Expand CORS to 500 stations	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Aeronautical Charting System: The Aeronautical Charting Program will probably be transferred to the Department of Transportation, possibly in 1999. Legislation is required, and at this time it is not known if and when this will take place.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 99	FY 00	FY 01	FY 02	FY 03
Nautical Charting and Surveying	Development/ enhancement	1,770	2,014	2,282	2,589	2,938
	Steady state	245	270	297	327	360
Real-Time Observations and Forecasts	Development/ enhancement	1,000	1,300	1,300	1,000	1,000
	Steady state	1,000	1,200	1,250	1,450	1,650
DPAS	Development/ enhancement	350	350	400	350	400
	Steady state	650	675	700	725	750
Geodetic Support System	Development/ enhancement	490	502	526	552	580
	Steady state	1,650	1,745	1,831	1,924	2,017

Future Investments: Plans are being developed to implement local coastal ocean current and water level forecasts on PORTS. An enhanced PORTS would be part of the Coastal Forecast System (CFS) with the NWS that will enable marine information and products to be exchanged with the SAFSEAS of NWS and with external users.

STRATEGIC GOALS: BUILD SUSTAINABLE FISHERIES AND RECOVER PROTECTED SPECIES

The Programmatic Goals and Objectives: NOAA's "Build Sustainable Fisheries" goal seeks to increase the Nation's wealth and quality of life by ensuring sustainable fisheries that can provide safe seafood, a healthy fishing industry, and recreational opportunities. Objectives for helping to meet these goals are: assessing the status of fishery resources, advancing fishery predictions, managing for economic growth, ensuring adequate compliance, and providing research and services for fishery-dependent industries. The primary Line/Program Offices involved in this goal are NMFS, OAR, and the Coastal Ocean Program Office.

Through the "Recover Protected Species" goal, NOAA will conserve marine species and recover those in danger of extinction. By 2004, NOAA will be on the road to recovering marine species at risk and maintaining the healthy coastal ecosystems upon which they depend. To accomplish this goal, NOAA's objectives are to conserve species by implementing recovery and conservation plans and to monitor, assess, and predict the status of protected species and their ecosystems. The budget estimates shown may undergo significant revision as a result of the business process re-engineering taking place in NMFS.

Since the same IT systems support both of these goals, as well as the NMFS portion of the Sustain Healthy Coasts goal, they will be dealt with together.

National Marine Fisheries Service System: NOAA Fisheries is implementing an enterprise Fisheries Information Technology (FIT) architecture that provides an IT Principles-Centered framework for managing technology change. Endorsed by the Fisheries' Executive Board and its National Information Management Board, development of all new systems and conversion of existing ones will be in compliance with the FIT architecture. The ability of NOAA Fisheries to successfully meet the Strategic Goals of "Build Sustainable Fisheries," "Recover Protected Species" and "Sustain Healthy Coasts" will be significantly enhanced with its implementation. More timely access to required data and information will improve NOAA Fisheries' ability to make predictions concerning the future of living marine resources and their habitat, as well as to estimate the impact of alternative proposed management and protective measures on U.S. citizens and industries.

The NMFS System supports the management and protection of living marine resources. NMFS is implementing a Fisheries IT architecture which will provide a framework for integrating new acquisitions with exiting capabilities.

The initial foundation of the enterprise FIT architecture for the 21st Century (FIT21) will incorporate three components: a more secure IT Environment, a transition towards conducting business processes as a Web-based agency, and tools to foster a well-informed and trained

workforce. Currently, the primary focus is on the FIT Foundation Technologies aspects of these components: Common Services such as network communications, E-mail, remote access to desktop applications, video conferencing, security, and training; and Business Processes Applications such as a standard methodology for systems/applications development within Fisheries and a prototype tracking system.

The continued implementation of the enterprise FIT architecture will accommodate the sometimes diverse IT requirements of regulatory functions versus those of scientific research. NOAA Fisheries business processes must incorporate the capability to collect and analyze data on living marine resources as well as the ability to use the resulting data and analyzes in the development and implementation of appropriate regulations and policies. To this end, the FIT architecture incorporates a Standards Profile for commercial off-the-shelf (COTS) software; COTS hardware and communications products; and industry protocols, interfaces, and services. These standards, however, are not mandates but strong recommendations; more important is the ability to use the appropriate IT to achieve the NOAA Strategic Goals.

The FIT architecture Standards Profile presents recommendations in a hierarchy based on a model described in the March 1996 Forrester Report, "*Sinking the IT Iceberg.*" The hierarchy is composed of three levels:

- **!** Foundation: enterprise-wide implementation, high impact on business activities, used for functions such as E-mail, financial systems, and TCP/IP;

- **!** Building Block: greater flexibility in the implementation, impacts individual business functions differently; used for functions such as network operating systems and desktop suites and platforms; and

- **!** Watch List: scattered implementation of emerging or specialized technologies such as multidimensional databases, Java development tools, and data visualization tools.

The enterprise FIT architecture will use this model to manage technology change as various technologies move from Watch List to Building Block, on to Foundation, and perhaps off to Obsolete. The Standards Profile will be reviewed periodically to ensure timely implementation of appropriate IT within NOAA Fisheries.

NOAA Fisheries is committed to deploying quality applications and databases to effectively perform the objectives related to the NOAA Strategic Goals. The development methodology, recommended for nationwide implementation by the enterprise FIT architecture, strives to avoid common pitfalls such as runaway projects, ineffective use of resources, not meeting mission requirements, incompatible "stove pipes", and lack of metrics to substantiate benefits. Fisheries recommends that its systems application developers use a checklist type scorecard, adopted from the *"Software Project Survival Guide"* by Steve McConnell, to evaluate the potential success of a particular project. In addition, a Headquarters Developers Team now meets routinely to share lessons learned and to discuss technologies or applications projects.

System Status and Plans - NOAA Fisheries is participating in the NOAA-wide move to Netscape Messenger as an electronic messaging platform that will provide a standardized approach for E-mail, meeting/conference scheduling, and calendar functions. Roll-out of the Netscape suite to the 2,700 Fisheries staff at 63 locations nationwide will be facilitated by the Fisheries Chief Information Officer (CIO) , the National Information Management Board, and the Regional Information Technology Coordinators (RITCs). In addition, the Fisheries' CIO provides nation-wide video conferencing capabilities for 13 sites.

A pilot project is underway to provide senior management at Headquarters with remote access to their desktop applications, including E-mail, calendaring, database applications, and NOAA Intranet Web sites. The CITRIX WINFRAME "thin-client" technology enables complex applications to be performed on network terminals or low-end PCs and accessed by remote users over low-speed modem connections. This remote-access capability will be expanded to include all Headquarters staff and Regional staff as resources become available.

NOAA Fisheries also is participating in the NOAA-wide implementation of COTS security software, Security Tools 2000, to automate and standardize the development of security, disaster recovery, and risk assessment plans. The Fisheries IT Security Officer (ITSO) will ensure implementation at Headquarters and will provide training and guidance to RITCs for implementation by system owners in the Regions.

A pilot project which provides Fisheries staff with access to computer-based training (CBT) on IT-related topics via a Web site is underway. NOAA Fisheries is using CBTWeb, which is a system developed by CBT Systems, for deploying computer training courseware over an Intranet or the Internet. Thirty-three courses, available via the Web site for three months, cover topics such as Windows 95, MS Excel 97, MS FrontPage 98, MS PowerPoint 97, Visual Basic 5.0, Oracle Developer 2000, Internet security, and firewall principles. If this pilot project is successful, access to the Web site and courseware will be provided to all Fisheries' staff on a continual basis.

A prototype tracking system to manage, track, and route correspondence and documents for review and concurrence within Headquarters is under development using Lotus Notes. Currently, it is difficult and time-consuming to verify that the appropriate offices and individuals have reviewed and signed-off on a given document. Once successfully implemented in Headquarters, the system will be expanded for use in the Regions.

In accordance with the FIT21 objective of increasingly conducting NOAA Fisheries' business processes via an Intranet and the Internet, numerous Fisheries' home pages are linked to the URL http://www.nmfs.gov. These Internet sites provide the public with a wide variety of data and information concerning the management and protection of our living marine resources. Examples of available information include commercial and recreational marine fishing statistics, procedures for applying for vessel permits, foreign trade data, research efforts, and relevant fishery laws. Intranet sites for financial reports, the FIT architecture status, and Y2K information are examples of improved staff access to information needed for internal business processes.

In compliance with the Paperwork Reduction Act of 1995 and the Clinger-Cohen Act of 1996, NOAA Fisheries continues to explore ways to use IT to reduce the burden on the public from requests or requirements for information from the Federal government. Of the four efforts underway, the Alaska Fisheries Electronic Reporting System is fully operational, the Vessel Monitoring System is partially operational, the Electronic Fish Catch Logbook is in the development stage, and the National Fishing Vessel Registration and Fisheries Information System is being considered for development.

The Alaska Fisheries Electronic Reporting (ER) System gives fish processors involved in managed fisheries the choice of reporting electronically. The required software can be downloaded from the ER System home page or accessed via CD-ROM. Developed by the NOAA Fisheries Alaska Regional Office, the ER System became operational in March 1998 (http:/www.fakr.noaa.gov/NMFS_ERWeb/index.htm). Previously, these reports could be submitted only in paper or fax form. Reporting now is easier and more accurate.

NOAA Fisheries currently uses the Vessel Monitoring System (VMS) to track the location of selected vessels, on an hourly basis, while the vessels are at sea in the waters off Hawaii and New England. The system is accurate to 100 meters and allows NOAA Fisheries to monitor a vessel's compliance with open and closed fishery seasons or time periods, areas closed to fishing, and international boundaries. The use of automatic reporting equipment enhances NOAA Fisheries' ability to meet its objectives for the "Build Sustainable Fisheries" Strategic Goal as well as reducing or eliminating the need for fishing vessels in some fisheries to make reports when they leave and return to port and at other specified times. For example, an estimated 120 vessels in a Hawaiian fishery can now use a VMS instead of providing hourly position reports. Also, the New England scallop "days-at-sea" fishing fleet, about 240 vessels, has been required to carry VMS since May 15, 1998. The increased flexibility in reporting requirements translates into increased profits for the vessel owners. There are issues, however, concerning the cost of this equipment, so it is not appropriate for all situations. Development efforts continue in order to expand the use of this technology.

The NOAA Fisheries Northwest Science Center is developing a prototype Electronic Fish Catch Logbook (EFCL) for potential use aboard fishing vessels (http://www.nwfsc.noaa.gov/logbook/). Begun in 1997, the project is funded by the Innovation Fund Committee of the National Performance Review. In managed fisheries the participants are usually required to complete logbooks containing information on their fishing effort and catch. These reporting requirements can be imposed either by NOAA Fisheries or a state. By coordinating with the commercial and public sector participants in the development of an electronic logbook, the project managers anticipate that Federal and state fishery managers will be able to obtain access to standardized and higher quality data while reducing the reporting burden upon the fishermen. Wide-spread implementation would facilitate better management of the fisheries in support of the NOAA Strategic Goal "Build Sustainable Fisheries". To date, requirements have been identified and prototype specifications developed; the project now is exploring potential participation by private partners in creating subsystem modules and components.

In response to requirements of the Sustainable Fisheries Act of 1996, NOAA Fisheries has proposed a design for a National Fishing Vessel Registration and Fisheries Information System. Further development depends upon the yet-to-be-made final decisions regarding the system to be used and the funding to support its development.

NMFS System Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
# of databases shared within NMFS and/or with other Government agencies/Councils	42/42	46				
# of interoperable, geographically-dispersed NMFS information systems	2/2	3/4				
% implementation of Fisheries Information Technology (FIT) Architecture		15	25	40	80	85

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

NMFS System Milestones	FY Goal
Define draft Fisheries IT target architecture	FY 98/FY 98
Conversion and testing of distributed processing systems	FY 99
Initial migration of databases to target architecture	FY 00
Develop and implement regional information and database management systems	FY 97 - FY 03
Refreshment of technologies to keep pace with industry advances	ongoing

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and "steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 99	FY 00	FY 01	FY 02	FY 03
NMFS System	Development/ enhancement	350	350	350	350	350
	Steady state	3,650	3,650	3,650	3,650	3,650

STRATEGIC GOAL: SUSTAIN HEALTHY COASTS

The Programmatic Goal and Objectives: NOAA's goal to Sustain Healthy Coasts is based on the following supporting objectives: to protect, conserve, and restore coastal habitats and their biodiversity; to promote clean coastal waters to sustain living marine resources and ensure safe recreation, healthy seafood, and economic vitality; and to foster well-planned and revitalized coastal communities that sustain coastal economies, are compatible with the natural environment, minimize the risks from nature's hazards, and provide access to coastal resources for the public's use and enjoyment. The primary Line/Program Offices involved in this goal are NOS, OAR, NMFS, NESDIS, and the Coastal Ocean Program Office. In order to meet the objectives, investments in scientific and coastal resource management are required.

Information Technology Support: Information technologies have an increasingly important role in providing scientists and managers with tools to improve their ability to understand and manage our Nation's coastal resources. This goal, however, is not supported by any individual major systems. Most of the IT needs of the scientists and resource managers involved are satisfied by common computing, networking, and mid-level workstation equipment, and by commercially-available Geographic Information Systems (GIS), DBMS, statistical analysis, and related analytical software. The Internet and CD-ROMs also play important roles in disseminating information to coastal management users. Five of NOAA's Line and Program Offices have activities under this goal, with seventeen individual programs involved, and these IT resources are distributed throughout these organizations.

IT support is based mainly on PC, scientific workstation, and Internet resources. Primary IT needs for the future relate to model development, information sharing, and administration/management tools

Much of the effort in meeting this goal's objectives involve resource management and protection supported by scientific research, monitoring, and assessment; scientific field and process studies and monitoring; information coordination; data management; archiving; and national-scale assessments. A need for grants administration, project management, and an information-sharing system to improve sustainable coastal communicates may be the focus of a future initiative. A seamless database of geo-referenced coastal information is needed to support the many NOAA efforts related to coastal environmental monitoring, assessment, management, and restoration.

Additional efforts may be directed toward developing new scientific processes to deal with harmful algal blooms and hypoxia, ensuring the proper use of science in coastal zone management decisions, developing restoration plans, and promoting coastal zone management activities such as habitat restoration and protection in the National Marine Sanctuaries and the National Estuarine Reserve System. Improving the ability to respond to natural and technological events including oil and chemical spills will require investments in integrated local/Federal planning, improvement

of scientific assessment tools, evaluating spill mitigation measures, and refining models used to estimate threats from spills and natural hazards.

Sustain Healthy Coasts IT Support Milestones	FY Goal
To be determined	

NOAA-WIDE INFRASTRUCTURE CAPABILITIES

NOAA also has initiatives underway that serve NOAA as a whole. These initiatives are not directed at accomplishing any single strategic goal, but are directed at providing the underlying infrastructure or improving the administrative services that allow NOAA to efficiently operate as a unified organization and to support collaboration and teamwork.

Commerce Administrative Management System (CAMS): CAMS is a Department-wide effort to modernize and integrate its financial and administrative management systems and streamline related business processes. The goal of CAMS is to employ modern technology to provide managers with standardized, accurate, and timely information to manage their resources while at the same time reducing administrative costs. Additionally, CAMS will be compliant with the Joint Financial Management Improvement Program (JFMIP) requirements for financial systems.

NOAA and DOC senior management has modified the CAMS schedule, re-organized the CAMS Office, and reduced implementation risk in response to an IV&V of proof-of-concept test results.

The mission of the NOAA Office of Finance and Administration CAMS Program Office is to coordinate the development and implementation of the Core Financial System (CFS) and other CAMS component systems throughout NOAA. NOAA is using a "team approach" in designing, developing, and implementing these component systems and an incremental approach to implementing CAMS NOAA-wide.

The supporting system architecture for CAMS is an increasingly Open Systems Environment that provides for interoperability (i.e., linkage or inter-connectivity) of hardware/software as well as portability of data and applications across diverse computing environments. Inter-connectivity of the systems will evolve to become seamless; financial data will be administered by the program managers; and distributed data processing will support bureau-unique, program-unique "business cultures."

The CAMS concept of operations is to use standard financial management software across hardware platforms, maintain that software centrally, ensure a single-entry source capture of financial data at point-of-origin, and implement paperless processing using electronic forms, routing, and approvals. Furthermore, CAMS will provide for the automatic validation of funds availability and commitment/reservation; "embed" intelligence that improves data integrity and reduces the need for reconciliations/corrections; and make available up-to-date official financial data on-line.

Tangible benefits that will be realized from CAMS are cost and FTE savings, improved productivity, elimination of "cuff" systems, Electronic Commerce/Electronic Data Interchange, and Prompt Payment Act compliance. Other benefits include improved timeliness, accuracy, and reliability of financial data; improved services/products (mission support); state-of-the-art new

systems; increased capability; more efficient database manipulation; productivity increases; better user-interfaces; and improved stewardship.

System Status and Plans - The NOAA CAMS Office was the subject of an extensive Independent Verification and Validation (IV&V) conducted by Booz-Allen & Hamilton in the first quarter of FY 1999. The IV&V began in October of 1998 and was completed in January of 1999. The IV&V analyzed the NOAA CAMS strategy, schedule, associated budget/resources required to successfully implement CAMS, and the technical architecture and capabilities of the existing NOAA hardware and software.

Based on the final Booz-Allen & Hamilton IV&V report, NOAA CAMS is in the process of conducting extensive discussions with senior NOAA and DOC management to modify the NOAA CAMS schedule, reorganize the NOAA CAMS office, and reduce implementation risk.

Following further analysis of anticipated NOAA CAMS implementation costs, the NOAA Deputy Undersecretary directed that the NOAA CAMS implementation schedule be expanded to approximately three years from the present day. The result will be a fully deployed CAMS at the beginning of FY 2002. This revised schedule is being instituted to fit NOAA's funding capability.

The following adjustments have been made recently to the NOAA CAMS program to ensure a successful implementation at NOAA and to secure the system's long-term viability:

1. The NOAA CAMS Program Office has been reorganized to serve under the NOAA Finance Director, R. J. Dominic. This will align NOAA CAMS with its major stakeholder, provide senior-level accountability, and strengthen the NOAA CAMS Financial Management leadership and support. The NOAA CAMS Program Manager will now report to the Director, NOAA Finance.

2. The CAMS Program Office will assume more IT responsibilities to include the IT planning/coordination for CAMS-related issues. This will include coordination with the ASCs and Line Offices.

3. The possibility of being cross-serviced by Census for some IT services will be explored.

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4. A NOAA CAMS Implementation Board has been established and the Board's initial meeting was held February 24, 1999. The Board is chaired by the NOAA Finance Director and is comprised of the Line Office Management and Budget Chiefs; the NOAA Budget Officer; the Chief of Acquisitions, Grants, and Facilities; the Chief of the Information Systems Office (ISO); and the Director of the NOAA CAMS Program Office. This Board will enhance the ability of the NOAA CAMS Implementation Center to focus on and resolve implementation issues.

5. NOAA CAMS senior management will continue the bi-weekly meetings with DOC's CFO or designee and the bi-weekly "War Room" meetings with the DOC CAMS Support Center (CSC). Quarterly briefings to the NOAA Deputy Undersecretary (DUS) and the

Deputy Assistant Administrators will be instituted to provide information regarding NOAA CAMS progress and costs. Furthermore, quarterly communiques on the status of CAMS will be introduced from the DUS.

6. Regular status reports, based on the Red Light/Green Light system used during the Census pilot, will be established for NOAA and DOC senior management.

7. A technical project manager at the DOC CAMS Support Center will be established to better coordinate and manage technology aspects of the CAMS project.

8. To improve the interaction between the CAMS Program Office and ISO, a systems architect is being hired and will be located in Gaithersburg at the NOAA IC.

9. Steps will be taken to improve DOC's management of all CAMS-related contracts.

In February of 1999 the Department's Assistant Secretary for Administration and Chief Financial Officer formally asked the Department of Interior (DOI) if a cross-servicing agreement with NOAA was feasible and at what cost. DOI uses the financial management system developed by American Management Systems (AMS). DOI responded to the Department's inquiry by requesting that a series of meetings with NOAA CAMS personnel be scheduled to determine the exact nature of NOAA's functional and technical requirements, and to see if there is a fit with the services they could provide. These meetings are currently underway. If a proposal is made by DOI, NOAA will evaluate their proposal based on cost, functionality, and technical aspects in comparison with CAMS software.

CAMS Performance Measures*	**FY 98**	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**
Accounts Payable						
# of days for reimbursement of expenses to employees	10/10	6/8	6	1	1	1
Reduce/Eliminate reliance on current legacy systems	10%/ 10%	30%	50%	100%	100%	100%
Reduce Prompt Payment Act interest payments	5%/5%	10%	25%	50%	50%	50%
Eliminate duplicate key entry	-	10%	30%	60%	60%	60%
Increase electronic file transfer (EFT) payments	10%/ 10%	50%	100%	100%	100%	100%
Reduction in rejects	-	5%	10%	20%	30%	50%

CAMS Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Increase in transactions processed	-	20%	50%	100%	100&	100%
Accounts Receivable						
# of days for recording deposits (Lockbox)	3/3	3	3/2	2/1	1	1
# of minutes to create billings	35/35	35	35/5	35/5	5	5

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

CAMS Milestones*	FY Goal
CFS: General Ledger (closing); Full deployment of Accounts Payable; Limited deployment of Accounts Receivable; Set up Budget Execution and Cost Accumulation. CAMS: Full deployment of Procurement, Travel, and Bankcard.	FY 00/FY 99 FY 01/FY 99
CFS: Full deployment of General Ledger, Accounts Receivable, Budget Execution, Cost Accumulation., and T&A CAMS: Full deployment or interface of Real Property, Personal Property, Grants, and Inventory.	FY 01/FY 99 FY 01/FY 99
CFS: Enhance CFS to 100%. CAMS: Enhance all modules to 100%.	FY 02/FY 01 FY 02/FY 00

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

Information Technology Center (ITC): A government agency that conducts its administrative and business functions in an efficient and effective manner is the mark of a well-managed organization. In recent years Congress and the Administration have placed special emphasis on improving and streamlining administrative functions. Mandated reforms such as the Government Performance and Results Act, the Information Technology Management Reform Act, the CFO Act, just to name a few, as well as the National Performance Review, have served to promote high-quality, responsive, and cost-effective

ITC information technology initiatives support the Department's E-Commerce and Digital Department Programs by focusing on the establishment of a standards-based, open-networking infrastructure; an enterprise business-management system; and an information services data architecture.

administrative functions in government operations. Generally in each of these reform efforts, information technology is seen as a powerful tool for improving government services and reducing costs.

The mission of the Information Technology Center (ITC) of the Information Systems Office within the Office of Finance and Administration is to provide NOAA and DOC with cost-effective enterprise-wide computing, networking, and information systems services for administrative, financial, and management functions. The ITC provides its clients with an array of key computing services which include operating the accounting, grants, and payment systems; managing the national wide-area network; managing the e-mail hub and address directory; hosting the administrative and management Home Page; providing production control for payroll processing; maintaining the employee locator database; and maintaining specialized databases used for personnel and facilities management.

System Status and Plans - The ITC's government and contractor staff has been successful in exploiting new information technology to respond to the demands of increased administrative workloads that are the result of shrinking budgets and personnel downsizing. The staff has designed, developed, and implemented IT business solutions which have made NOAA and DOC more efficient organizations. For example, the modernization of the WAN to a TCP/IP, Frame Relay, and router-based network has resulted in savings of $120,000 annually. During a typical business day the ITC processes 70,000 electronic mail messages; 2,100 logins; 1,500 batch jobs; 40,000 Web hits; 60,000 printed pages; 5MB of WAN traffic; and 3,100 X.500 directory searches. Each bi-weekly payroll period the ITC Payroll Operations processes and transmits over 14,000 payroll records to the National Finance Center.

However, the advances toward administrative improvements remain rudimentary. As a result, demands on the information technology professionals in the ITC will grow with increasing workload from new initiatives.

ITC Information Technology initiative plans, which are focused on providing the infrastructure to support the Department's E-Commerce and Digital Department Programs, are to implement a standards-based, open-networking infrastructure; implement an enterprise, comprehensive, integrated business-management system; and design and implement an information services data architecture.

The new network will be a vendor-independent, standards-based, open-network architecture. Its scope is beyond the traditional file and print services of LAN architectures. In its broadest sense it includes both Intranet and Internet services as well as routine communications and network services. It presents the network as an open and accessible utility from which services can be obtained and applications accessed from any point on the network through direct or indirect means. The network is viewed as a shared common resource that is the main vehicle for transacting daily administrative, financial, and administrative business both inside and outside the organization. The LAN as a local or self-contained network becomes virtually an obsolete concept. Connectivity and access to any network resource, local, national or international, drives the architecture. Access internally to NOAA's and DOC's large and diverse computing and

database resources, as well as extensions to the academic, scientific, and governmental communities, defines the scope of the network.

The second initiative, fully automating and integrating enterprise administrative functions, will reap many benefits to the Department. The ITC is committed to deploying a standard suite of business applications based on proven software and services. The current mixed-vendor environment, with non-standard software, is very inefficient. A common user interface and common database is required for all of the following functions: financial operations, procurement, asset management, budgeting, grants, billing and collections, payroll, human resources management, and other specialized business and administrative functions. Deploying enterprise business applications is an extremely challenging effort that will require dedication from both ITC and commercial resources.

And finally, an Information Services Environment that provides an efficient data architecture as well as the means to readily access information is a major initiative. Web and Java-enabled applications that lower the cost of client-server computing without reducing the benefits are but two examples of where the ITC can improve the effectiveness and efficiency of enterprise business functions throughout DOC.

ITC Performance Measures*	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Network operations support for NOAA Line and Staff Offices:						
% of e-mails processed within 5 minutes	80%/ 80%	80%	80%	80%	80%	80%
Maximum latency for any e-mail	1/1 hr	1 hr	1 hr	1 hr	1 hr	1 hr
# of Internet support accesses (hits)	1M/1M	2M	3M	4M	5M	6M

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 98 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 98 Strategic Information Technology Plan.

ITC Milestones*	FY Goal
Implement Network Operating Environment	FY 99
Implement full data warehousing capabilities on the Alpha cluster (a management review concluded this should be deferred)	Deferred to out years/FY 99
Provide upgraded telecommunications services on the NOAA-net Wide-Area-Network	FY 00
Develop Digital Department initiatives	FY 00
Implement Digital Department initiatives	FY 01

ITC Milestones*	FY Goal
Provide full audio and video Internet services on the Wide-Area-Network	FY 01

* When two years are presented and divided by a "/", the first year represents the FY 98 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 98 Strategic Information Technology Plan.

High Performance Computing and Communication Program (HPCC): In recognition of the importance of high performance computing and communications to its mission, and in support of NOAA's active participation in the Federal interagency HPCC Program (now coordinated through the National Science and Technology Council; Technology Committee; Subcommittee on Computing, Information, and Communications), NOAA has an HPCC Program Office. This Office receives directly appropriated NOAA HPCC funding, and supports high-end computing and advanced networking across NOAA. The HPCC Office also manages NOAA's participation in the new Presidential initiative "Information Technology for the Twenty-first Century (IT^2)".

The HPCC high-end computing support focuses largely on NOAA's three high-performance computing installations: the National Centers for Environmental Prediction (NCEP), the Geophysical Fluid Dynamics Laboratory (GFDL), and the Forecast Systems Laboratory (FSL). The HPCC Office supports enhancements in the computational capabilities of these installations so they can better meet the needs of the HPCC Grand Challenge applications of climate prediction and weather forecasting. These installations are described elsewhere in this document. The Program also supports Visiting Scientists and other researchers who focus on preparing NOAA to take advantage of massively-parallel computing architectures.

The HPCC advanced networking support focuses on improving NOAA's connectivity to the Internet, so as to improve its ability to disseminate data and information more completely and in a more timely way. Since the HPCC Program is a research program, the networking projects it supports across NOAA usually involve the use of leading-edge technology, including the development and evaluation of test beds. Current emphasis areas include the use of advanced collaboration tool, virtual laboratories, and preparation for NOAA connection to the Next Generation Internet. The HPCC Program supports NOAA's participation on the World-Wide-Web, developing and improving the NOAA Home Page, developing special NOAA-wide sites such as the NOAA Year of the Ocean site, and a registry of NOAA Web sites, and establishing a NOAA Web video/web server.

More information is available on NOAA's HPCC Office at its Web site at (http://www.hpcc.noaa.gov).

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. In accordance with the reporting format required by OMB, the budget estimates are divided into two categories: "development/enhancement" and

"steady state". The first category is used for expenditures for developing a new IT system or enhancing an existing system. The second category is used for expenditures for just maintaining a current system.

System		FY 99	FY 00	FY 01	FY 02	FY 03
CAMS*	Development/ enhancement	8,369	11,335	6,598	0	0
	Steady state	1,769	4,869	5,057	5,812	4,625
ITC	Development/ enhancement	1,100	1,200	1,300	1,400	1,500
	Steady state	0	0	0	0	0
HPCC/IT^2	Development/ enhancement	12,000	19,200	21,500	21,500	21,500
	Steady state	0	0	0	0	0

*CAMS figures include the following money from the Working Capital Fund charges: $6.2M in FY 99, $8.0M in FY 00, and $8.0M in FY 01.

Future Investments:

Connectivity and Networking: As discussed in the Strategic Issues section of this document (see "Information Services Delivery" on page 7), NOAA has recognized the importance of connectivity and networking to its ability to carry out each of its strategic goals. NOAA has also recognized that investments in this area need to be coordinated so that NOAA as a whole can benefit. An initiative that helps NOAA implement its networking architecture is being developed for possible inclusion in NOAA's FY 2001 budget request. This initiative is "cross-cutting" in that it contributes to the accomplishment of all seven of NOAA's strategic goals.

Virtual Laboratories: The Vice President has asked Federal agencies to explore the concept of "virtual laboratories" with several states of the southeast with an eye to developing pilots among those states and Federal laboratories. The states in the region have chosen the environment as one of the initial focus areas for pilots. With NOAA's strong laboratory system and track record of university partnerships, including such activities as Sea Grant and the Joint Institutes, NOAA is viewed by many as an important partner in any such virtual laboratory experiment. In addition, local NOAA resources such as the National Climatic Data Center, the Coastal Services Center, and hurricane activities are viewed as potentially important resources for this activity.

Initial planning meetings have been held among representatives of North Carolina, South Carolina, Georgia, Alabama, Tennessee, and Federal agencies. Further planning will lead to the selection of specific virtual laboratory pilots.

Property Management System: Since 1990 NOAA and other Department of Commerce Bureaus have utilized the Department of Agriculture's National Finance Center's (NFC) Property Management Information System (PMIS) to track accountable personal property. This legacy system is cumbersome, inaccurate, extremely difficult and costly to modify, and not easily accessible to NOAA managers. While NOAA is already making property-related information available on the World-Wide-Web and provides interactive pages to conduct a number of property management actions, these improvements work around the fact that the PMIS cannot produce the end-of-year and other financial reports required for the NOAA Financial Statement or meet other essential needs. In order to meet audit requirements for the past two years, the Property Office has had to manually produce the end-of-year reports required by the Finance Office. Monthly depreciation of capitalized property can not be posted to the General Ledger because the PMIS does not calculate depreciation correctly. NOAA is considering the acquisition of software that would better meet NOAA's requirements for accurately monitoring accountable property under NOAA's responsibility.

CONCLUSION

The contents of this plan have shown how NOAA's ability to maintain and improve its service to the Nation depends upon the wise and successful use of IT resources, and that NOAA is using technology both to re-engineer vital business processes and to significantly improve specific services. The plan has also shown that in a diverse agency like NOAA, a wide range of IT actions are needed; NOAA's challenge is to conduct this wide range of activities while maintaining sufficient coordination so that NOAA's IT systems work in an efficient and integrated way. IT is a tool, and it should now be clearer how the tools are to be used and for what purpose. The plan has provided both a comprehensive view of the critical systems and a means for achieving consensus about NOAA's future IT strategy. Management endorsement of this strategy provides direction for NOAA's future IT-related activities.

As stated in the Preface, this document is part of an annual planning and budgeting cycle. As NOAA's planning moves through the next steps in this cycle, and implementation actions start to be taken, there will be adjustments and changes in the plans. Within available resources, and considering changing needs, decisions will have to be made as to which programs and initiatives have the greater priority. These changes will be reflected in the subsequent IT planning activities – the NOAA Operational IT Plan and the supporting documentation for budget initiatives. The Strategic IT and Operational IT Plans, used in conjunction with NOAA's 5-Year Implementation Plans and NOAA Line and Program Office Operating Plans, provide a framework for future tracking of progress and measuring the accomplishments of IT systems. By preparing these plans and documenting the "return on investment" that NOAA is achieving through its IT systems, NOAA is working to implement the management approach mandated by the Government Performance and Results Act.

ACRONYM LIST

AC	Anomaly Collation
ACE	Advanced Composition Explorer
AFOS	Automation of Field Operations and Services
AHPS	Advanced Hydrographic Prediction System
ASOS	Automated Surface Observing System
ATOVS	Advanced TIROS Operational Vertical Sounding
AVHRR	Advanced Very High Resolution Radiometer
AWIPS	Advanced Weather Interactive Processing System
CAC	Computer-Assisted Compilation
CAMS	Commerce Administrative Management System
CEMSCS	Central Environmental Satellite Computer System
CDAS	Command and Data Acquisition Station
CFS	Core Financial System
CIO	Chief Information Officer
CIP	Critical Infrastructure Protection
CIRT	Computer Incident Response Team
COADS	Comprehensive Ocean-Atmosphere Data Set
COMPS	Customer Order Management Processing System (Data Centers)
CONOPS	Concept of Operations
CONUS	Continental United States
CORBA	Common Object Request Broker Architecture
CORMS	Continuous Operational Real-time Monitoring System
CORS	Continuously Operating Reference Stations
COTS	Commercial-off-the-shelf
CY	Calendar Year
DMSP	Defense Meteorological Satellite Program
DOA	Department of Agriculture
DOC	Department of Commerce
DOD	Department of Defense
DPAS	Data Processing and Analysis Subsystem (for NWLON)
E-Commerce	Electronic Commerce
ENSO	El Niño-Southern Oscillation
EOSDIS	Earth Observing System Data and Information System
EPA	Environmental Protection Agency
ERL	Environmental Research Laboratories
ESDIM	Environmental Services Data and Information Management
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration
FBN	Federal Base Network
FEMA	Federal Emergency Management Agency
FIMA	Financial Management System
FIT	Fisheries Information Technology (Architecture)
FSL	Forecast Systems Laboratory

FTP	File Transport Protocol
GAO	General Accounting Office
GFDL	Geophysical Fluid Dynamics Laboratory
GIMTACS	GOES I-M Telemetry and Command System
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellites
GPRA	Government Performance and Results Act
GPS	Global Positioning System
GSA	General Services Administration
GSFC	Goddard Space Flight Center
GTACS	GOES Telemetry and Command System
HPC	High Performance Computing Capabilities
HPCC	High Performance Computing and Communications Program
HPCS	High Performance Computing System (FSL)
IBM	International Business Machines
IDS	Intruder Detection System
IJPS	Initial Joint Polar System
ISO	Information Systems Office (of Office of Finance and Administration)
IT	Information Technology
ITC	Information Technology Center (within the ISO)
JFMIP	Joint Financial Management Improvement Program
LAN	Local Area Network
MEI	Minimum Essential Systems
METOP	Meteorological Operational satellite (EUMETSAT/ESA)
MPP	Massively-Parallel Processor
NAOS	North American Atmospheric Observing System
NARB	Network Advisory Review Board
NASA	National Aeronautics and Space Administration
NASIRC	NASA Automated Security Incident Response Capability
NCEP	National Centers for Environmental Prediction
NEDASS	National Environmental Data Archive and Access System
NESDIS	National Environmental Satellite, Data, and Information Service
NEXRAD	Next Generation Weather Radar
NFC	National Finance Center
NGS	National Geodetic Survey
NGSIDB	NGS Integrated Data Base System
NIC	Network Information Center
NMFS	National Marine Fisheries Service
NNDC	NOAA National Data Center
NNT	Nearest-Neighbor Tool
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NOE	Network Operating Environment
NORC	NOAA Operations and Research Center
NOS	National Ocean Service

NPOESS	National Polar-orbiting Operational Environmental Satellite System
NSA	National Security Agency
NSRS	National Spatial Reference System
NSSL	National Severe Storms Laboratory
NSWP	National Space Weather Program
NTACS	GOES-N Telemetry, Acquisition, and Command Transmission Subsystem
NVDS	NOAA Virtual Data System
NWLON	National Water Level Observation Network
NWR	NOAA Weather Radio
NWS	National Weather Service
NWWS	NOAA Weather Wire Service
OAR	Office of Oceanic and Atmospheric Research
OFA	Office of Finance and Administration
OGE	Operations Ground Equipment
OMB	Office of Management and Budget
ORPG	Open Radar Product Generation (for NEXRAD)
OSTB	Office of Science and Technology Policy
PDD	Presidential Decision Directive
PIP	Product Improvement Program (for NEXRAD)
PMEL	Pacific Marine Environmental Laboratory
POES	Polar-orbiting Operational Environmental Satellites
PORTS	Physical Oceanographic Real-Time System
PPP	Point-to-Point Protocol
PUP	Principle User Processor (for NEXRAD)
RDA	Radar Data Acquisition
RFI	Request for Information
RFP	Request for Proposals
RPC	Rapid Prototyping Center
RPG	Radar Product Generation (for NEXRAD)
SAA	Satellite Active Archive
SARSAT	Search and Rescue Satellite-Aided Tracking
SBN	Satellite Broadcast Network
SCARS	Super Computer-Assisted Revision System
SEC	Space Environment Center
SELDADS	Space Environment Laboratory Data Acquisition and Display System
SMS	Scalable Modeling System
SOCC	Satellite Operations Control Center
SRS	Scalable Runtime System
SST	Sea Surface Temperature
STARS	Standard Terminal Replacement System
TCP/IP	Transmission Control Protocol/Internet Protocol
USAF	United States Air Force
USCG	United States Coast Guard
VA	Vulnerability Assessment
VPN	Virtual Private Network

WAN	Wide Area Network
WFO	Weather Forecast Office
WITS	Washington Interagency Telecommunications System
WSR	Weather Surveillance Radar
WWW	World-Wide-Web
Y2K	Year 2000